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# U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1746

## SUBSISTENCE FARM GARDENS



**V**EGETABLE GARDENS are an important factor in any subsistence-farming enterprise on account of the large amount of food that can be produced on a small area devoted to vegetables. Fruits, while not of as great food value as vegetables, are essential because they add variety to the diet. Combined with poultry and dairy products, and, under certain conditions, the production of the home supply of meats, the garden and orchard will furnish a large part of the family living. Furthermore, when a family grows its own fruits and vegetables more liberal use of these essential foods will be made than when the supply must all be bought in the market.

Under most conditions one-half acre planted to miscellaneous vegetables, one-half acre in fruits, and one-fourth acre in potatoes or sweetpotatoes will supply the average family with the greater part of this class of food that they will normally consume. Where the entire subsistence homestead operation is limited to an acre at least one-half of the area should be devoted to the garden and small fruits, but whenever the plan includes 3 to 5 acres, 1½ to 2 acres can be profitably used for the production of fruits and vegetables. This, however, will include a limited number of trees of the standard tree fruits.

Men who are employed only part time or short hours will have ample time during the spring and summer months to plant and tend a garden. Careful records have shown that under favorable conditions the time spent in the garden yields a return equal to that obtained for a corresponding period of time devoted to regular employment.

# SUBSISTENCE FARM GARDENS

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## INTRODUCTION

**F**RUITS AND VEGETABLES will naturally form an important part of the diet of families undertaking subsistence farming as a means of supplementing their food supplies and occupying their spare time. The supply of fruits and vegetables in most cases will be produced by methods differing more or less from those employed in regular farm gardens. This bulletin has been prepared with the limitations clearly in mind, under which the average subsistence homesteader is working, and includes brief cultural directions for about 20 of the most important garden vegetables, 5 of the small fruits, and 5 of the standard or tree fruits. The information contained herein applies mainly to climatic and other conditions prevailing in the Northern and Eastern States; the bulletin is not intended for distribution in the Cotton States, the Great Plains area, or the Pacific coast region. More complete cultural information may be obtained from the regular gardening bulletins of the United States Department of Agriculture and the State colleges and experiment stations.

## SOILS AND FERTILIZERS

Land that is available for subsistence farms may not always be of high quality or fertility, and every expedient will be necessary in order to produce reasonably good crops of fruits and vegetables on it during the first few years. In the course of time the land may be improved and made more productive. In any case the best land available should be selected for the garden. Where poultry or a cow is kept as a part of the subsistence-farming plan, the manure can be used to advantage on the garden and truck patch. In the absence of manure, certain soil-improving crops such as soybeans, clover, or even rye, can be grown and turned under to add humus to the soil. The moderate use of commercial fertilizer is recommended wherever it is obtainable and its use would be justified by increased production.

Wherever there is opportunity to choose the location of the vegetable garden, a southern or southeastern exposure should be selected; locations on low ground or where there is any danger of overflow should be avoided. Good drainage is important because wet soils are usually unproductive and cannot be worked early in the spring. Sandy loams and light clay loams are considered best for growing vegetables, but heavy clay loams can be made to produce good yields of most garden crops if they are lightened and improved by the addition of manure or some other form of organic matter. Composts of leaves, straw, and other waste products are often cheap sources of humus. Ten tons of manure will not be too much to plow under to improve the soil of a half-acre garden at the start, and this can be supplemented by applications of 4 or 5 loads of partly rotted manure each season if the manure can be secured. Poultry manure should be saved during the winter and kept dry, then spread on the garden early in the spring. It must be remembered that poultry manure is quite strong and must be used sparingly when applied near the plants. Sifted coal ashes or sand may be used moderately to lighten stiff clay soils.

Commercial fertilizers are an excellent source of nitrogen, phosphorus, and potash (three important elements needed by plants), but the value of the fertilizer depends almost entirely upon the amounts of these essential ingredients that it contains. Four hundred to five hundred pounds of a high-grade garden fertilizer such as one having a guaranteed analysis of 5 percent nitrogen, 10 percent phosphorus, and 6 percent potash, or some similar mixture, will generally be sufficient for a half-acre garden, especially if the land has been manured. Some crops like corn, potatoes, cabbage, onions, and lettuce require more fertilizer than snap beans, tomatoes, and peas. A portion of the fertilizer can be applied when the land is being fitted for planting; then the remainder can be used for top-dressing or side-dressing along the rows of plants during the growing period.

## PREPARING THE SOIL FOR PLANTING

The depth to plow or spade the garden will depend upon the character and the depth of the surface soil. Where the topsoil is 8 or 10 inches deep it should be worked to that depth, but where the topsoil is less than 6 inches deep, care should be taken to avoid bring-

ing any considerable amount of the subsoil to the surface, although it is a good plan to loosen the subsoil 6 to 8 inches deeper than the topsoil is turned. This can be done by the method known as trenching. Trenching should be done in the fall and early winter at such times as the condition of the soil and weather are suitable. The work of trenching may be made much easier if the land is handled in strips. Beginning at one side of the plot to be trenched the topsoil of a strip about 2 or  $2\frac{1}{2}$  feet in width is taken off and piled at one side. The subsoil is then broken as deep as possible with ordinary garden tools and then the topsoil from the adjoining strip no. 2 is thrown over to form the topsoil on strip no. 1. The subsoil of strip no. 2 is then broken up and the topsoil from strip no. 3 is turned over upon strip no. 2 and so on until the far side of the plot of ground is reached; then a wheelbarrow is employed and the topsoil from strip no. 1 is carted across and becomes the topsoil of the last strip to be worked. This involves considerable work but greatly improves the character of the soil, and can often be done a little at a time. Coarse manure, cleanings from the poultry house, or almost any form of compost or organic matter may be worked into the subsoil to loosen and improve it.

Where the garden is plowed with a team or tractor the soil should be harrowed very soon after plowing, in order to pulverize the lumps. In case the garden is spaded it is a good plan to break the lumps with the edge of the spade or spading fork as each spadeful is turned, and when a strip 5 or 6 feet in width has been spaded, the soil should be well raked to break the remaining lumps. The secret of getting a good seed bed is to pulverize the soil to the full depth that it is plowed or spaded. Under no circumstances should the soil be plowed or spaded when it is so wet that it will stick together in a ball when a small amount is squeezed in the palm of the hand, as being worked while wet will cause the soil to bake and become hard. Sandy loam soils can be worked sooner after a rain or irrigation than heavy clay soils, but even the sandy soils are injured if worked when they are too wet. After plowing, the soil may require repeated harrowing or dragging to break the lumps and make it fairly firm, as a very loose soil soon dries out and causes the plants to suffer for moisture.

#### WATERING THE GARDEN

The use of water on gardens will prove of benefit at some time during practically every gardening season; the method of applying it will depend upon the source of supply, the character of the land, and various other factors. In some cases water can be pumped from a spring, a well, or from a small stream; in other cases the water can be drawn from a city or town water supply, but the main point is to apply it when it is needed, and to give the plants enough to do them some real good. Market gardeners frequently employ overhead sprinkler systems for applying the water; others use the furrow system, running the water in small streams along the rows of plants; while in still other cases where the land is perfectly level the surface may be flooded and then the surplus water drawn off. Of these three systems the one where the water is run in the small furrows

along the rows is perhaps the most satisfactory for use in the subsistence garden. Under no conditions should the plants be sprinkled at frequent intervals, but the soil should be allowed to become reasonably dry and then given a thorough wetting, after which no more water will be required until the soil again becomes slightly dry.

Water, even in small quantities, is a great help in the setting of plants in the garden. The proper method of applying the water is to dig the holes and set the plants in them with a small amount of soil packed rather firmly about the roots. From a pint to a quart of water should then be poured into the hole and allowed to settle into the soil; the hole should then be filled completely with the soil in its natural state. In case newly set plants are given a second watering a day or two after being set, small pockets or holes should be made alongside of the plants and these should be filled with water; then, after the water settles into the soil the holes should be filled with soil.

Where water is supplied from a hose it should be allowed to run in a soft stream between the rows rather than to be thrown forcefully from a nozzle. The average subsistence gardener will be dependent upon local water supplies from wells or streams, and very simple methods of distributing the water should be worked out.

Mulching around the plants with straw or coarse manure or any material of like character will aid materially in conserving moisture during dry periods.

#### SEEDS FOR THE GARDEN

Seeds for the subsistence garden should always be arranged for and on hand well in advance of the planting season. In many cases the orders for garden seeds are pooled by groups of gardeners, and this results in considerable saving in the cost to the individual gardeners. Under normal conditions the seeds required to plant a half-acre garden, exclusive of seed potatoes and sweetpotato plants, will cost from \$3 to \$5, but by purchasing in quantity the necessary seed supply may often be obtained for \$2 to \$3. The cost of seeds, however, depends very largely upon the crops planted. If considerable quantities of peas and beans are planted the seed bill will be relatively high, as these are among the most expensive items in the seed budget. Seed potatoes are one of the most expensive items, but a small saving can be made when the potatoes are purchased in quantity and distributed to the various gardeners. In the case of sweetpotato plants the southern-grown plants can often be used, or a number of gardeners may combine in the construction of a small furnace-heated plant bed in which to grow their supply of sweetpotato plants. In purchasing seeds for the subsistence garden only high-grade seeds should be considered, even though the cost may be a little more. The use of poor seeds is very frequently the cause of failure and disappointment and low-grade seeds should not be used under any conditions.

Seedsmen who supply the seeds for subsistence gardens should be required to give guaranty as to both the germination and the general quality of the seeds furnished.

When the seeds are received they should be carefully unpacked and checked and kept where they will be reasonably dry and at

about a living-room temperature, also where there will be no chance of mice or rats destroying them.

Any seeds that are left from the planting of the garden should be carefully kept. Certain kinds of seeds will keep over from year to year, or second or even third plantings of some of the vegetables may be desirable. In some cases gardeners have been very successful in the saving of certain seeds from their own gardens. This is true of peas, beans, tomatoes, cucumbers, squashes, melons, and several other of the vegetables that form their seeds the same season that the crop is planted.

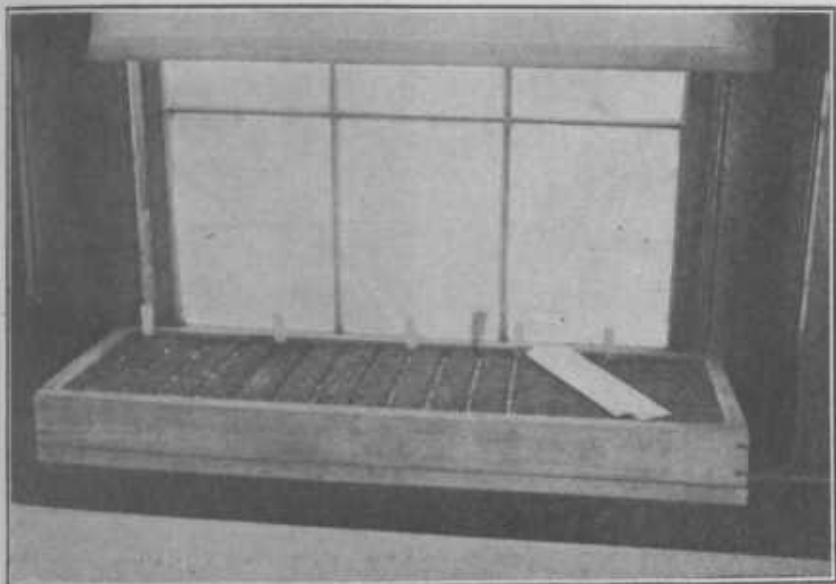


FIGURE 1.—Window box for starting early plants in the house.

The particular variety of any crop to plant will depend somewhat upon local conditions, and the inexperienced gardener should always seek the advice of the county agent or some local gardener who has had years of experience in the growing of vegetables for home use.

Recently there have been developed a number of varieties of disease-resistant vegetables, and these should be used whenever there is any reason to believe that the diseases to which the varieties are resistant may be present in the soil. Certain diseases are carried with the seed, but the average gardener has very little control over this except that he may insist upon being furnished with seed that has been treated for the control of these seed-borne diseases.

#### STARTING EARLY PLANTS

Earliness is of very great importance with a number of the transplanted crops like tomatoes, peppers, lettuce, and cabbage. Considerable time can often be gained by starting the plants in the house, using a window box of the type shown in figure 1. The window box can sometimes be supplemented by the use of a small coldframe, such as is



shown in figure 2. By the combination of the window box and the coldframe all of the early plants required for planting in the garden can be grown and ready to set out by the time the weather is warm enough. If the gardener is compelled to wait until the plants can be grown outdoors much valuable time will be lost in getting the crows ready for use.

A box or tray in which to start early seedlings should be about 8 inches deep and of the right size to fit into a south window of the living room or kitchen. Any good, light soil will do for starting the plants, but it should be sifted and enough old-rotted manure

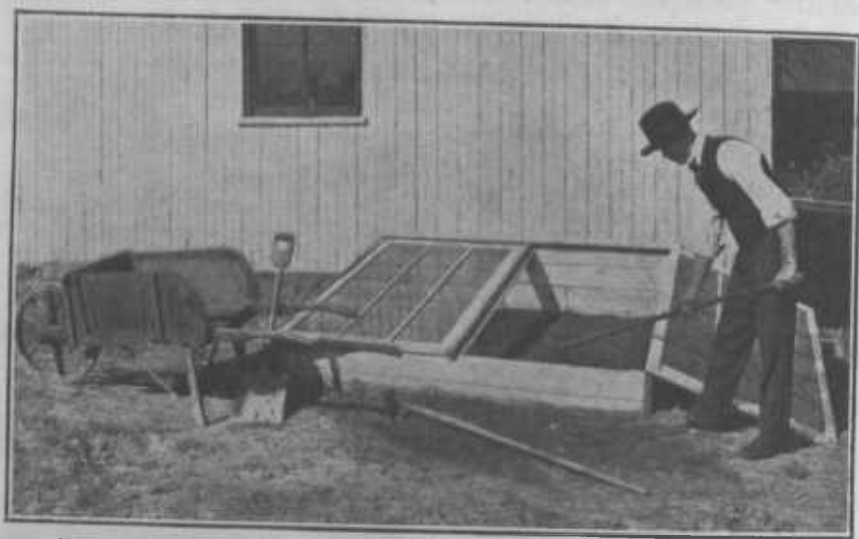


FIGURE 2.—Preparation of a sash-covered frame for starting early plants.

mixed with it to make it hold moisture and be rich enough to insure a good growth. The seeds may be sown in rows as indicated in figure 1, and they should be covered just deep enough to insure the proper amount of moisture to make them germinate. Care must be taken that the little seedlings are not overwatered, as an excess of water will often cause the appearance of a disease known as "damping off" which causes the plants to rot off at the surface of the ground. Careful watering and plenty of air and sunshine will ward off this disease.

When the plants have formed about one leaf in addition to their two seed leaves they should be transplanted to other boxes of soil or to the coldframe where they will have more room to spread out and develop plenty of roots. Later when the weather becomes warm the plants will be ready for planting in the garden. The coldframe may need to be protected during cold nights by spreading old matting, burlap bags, straw, or regular hotbed mats over it. On bright, sunny days the bed must be opened and the plants given a reasonable amount of air because if the temperature is allowed to run too high the plants will grow weak and spindling; in fact, 60° to 70° F. is about the right temperature for growing most plants.

Glazed sash 3 by 6 feet in size are the best covering for a cold-frame, but heavy unbleached muslin makes a fair covering and it can be kept rolled up and off the bed during bright warm days and put on again before the plants become chilled as the sun goes down.

### TOOLS

Elaborate or expensive tools are not necessary for the cultivation of a subsistence garden. For a small garden, that is, one-fourth acre or less, a spade or spading fork, a hoe, a steel rake, a line for laying off the rows, a garden trowel, and a watering can will be sufficient. For a one-half acre garden it will be desirable to have a wheelbarrow on the place and also a wheel hoe or hand cultivator of the type shown in figure 3. A combination wheel hoe and seed drill is desirable for use on gardens of one-half acre to an acre. On subsistence gardens where a horse is kept it is desirable to include a one-horse cultivator having several sizes of shovels and sweeps, as shown in figure 4. It pays to secure tools of good quality, then give them proper care, clean them after they are used, and keep them stored in a dry place. If this rule is followed the tools will remain in good condition for many years.

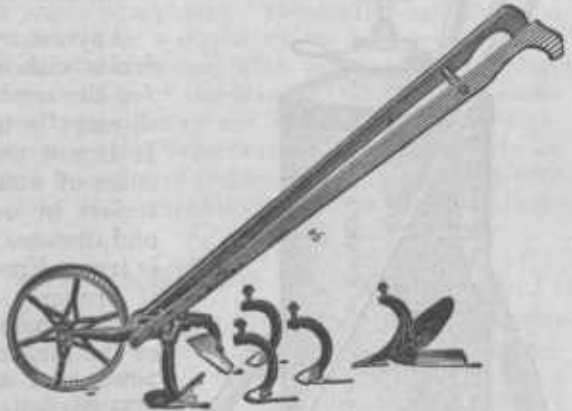


FIGURE 3.—A small hand cultivator, a desirable addition to the garden equipment.



FIGURE 4.—A five-shovel cultivator with attachments, adapted for garden cultivation.

in the small garden, but in the large garden and when there are fruit trees to be sprayed a wheelbarrow or barrel-type spray pump will be necessary. Very frequently one of these sprayers will serve for three or four gardeners and may be owned jointly or, what is perhaps a better

plan, will be owned by one of the gardeners and a small charge made for its use. There are several forms of dusters on the market, including the plunger, fan, and bellows types. The main point in selecting spraying and dusting equipment for use in the garden is to have attachments that will deliver the spray or the dust on the undersides of the leaves. This is especially desirable for the control of aphids, Mexican bean beetles, and other insects that work mainly on the undersides of the leaves.

#### DISEASE AND INSECT CONTROL

Anyone who plants vegetables or fruits without making definite plans for the control of insect pests and diseases is headed for sure failure. It is not necessary to spend large sums of money for advertised materials in order to control insects and diseases; quite often the reverse is true. Frequently a home remedy, if properly applied, will give just as much protection. Hand picking of the larger insects has been practiced ever since man planted his first garden, and when this practice is persistently followed the need for expensive poisons is lessened. The destruction of the refuse of each crop immediately after it is harvested prevents the continued breeding of large numbers of insects, which may migrate to later crops or to winter quarters. Community effort in cleaning up weeds, trash, and brush in which insects spend



FIGURE 5.—A compressed-air sprayer suitable for larger gardens.

the winter will greatly reduce the crop of pests for the next year.

When it becomes necessary to use insecticides, there are two main types to be considered—stomach poisons and contact insecticides.

Stomach poisons are materials used to kill insects by poisoning their food. It is not necessary to strike the insects with these poisons, but they must be placed on the plants on which the insects feed. The most common stomach poisons are paris green, lead arsenate, calcium arsenate, and magnesium arsenate.

Contact insecticides are used to kill insects which suck juices from the inside of the plants and by so feeding do not take up poison placed on the surface of the leaves and stems. It is therefore necessary to apply a contact spray or dust directly to the insect. The most common contact sprays are nicotine, pyrethrum, and soap combinations. Nicotine is very widely used as a dust.

Owing to their peculiar habits of securing food, some insects cannot be controlled by either of these types of sprays or dusts. Other materials, therefore, such as bichloride of mercury, bordeaux mix-

ture, and poisoned bait must be resorted to. To avoid arsenical residue on the plants, a material known as "rotenone", which is both a stomach poison and a contact poison, has come into common use. The present source of rotenone is derris and cubé root. The stomach poisons are cheaper and remain on the plants longer; hence they are used whenever possible.

#### SPRAYING AND DUSTING EQUIPMENT

There are available on the market various types and makes of equipment adapted for use in the home garden. The choice of a sprayer or duster depends on the size of the garden and the amount of money available for such equipment. Generally speaking, a 3-gallon compressed-air sprayer or a duster of the bellows or rotary type is advised. These can be obtained with attachments to place the dust or spray on the underside of the leaves. Small hand atomizer sprayers and plunger-type dusters are too small for the average home garden. Because certain insects feed almost entirely on the underside of the leaves, it is almost impossible to reach them with poisons applied from a cloth bag, sprinkling can, or a can with holes punched in the bottom.

#### STANDARD REMEDIES

As suggested in preceding paragraphs, there are certain remedies for disease and insect troubles that have become more or less standardized, and one mixture may serve for the control of the diseases or insects affecting several different crops. Furthermore, there are cases, like potatoes, where combination sprays or dusts may be used to control both the diseases and the insects at one application.

Spray materials may be purchased in small amounts from seedsmen, nurserymen, florists, and hardware and other dealers. Directions for use will usually be found on the package; also information as to the nature of the material, whether an arsenate of lead, bordeaux mixture, a nicotine sulphate, a wettable sulphur, etc.

The following discussion includes those spray materials herein recommended for use:

Arsenate of lead is for use in controlling leaf-eating insects. It is purchased as a white powder and is deadly poisonous to man and animals as well as to insects. It is used at the rate of about 1 ounce (2 heaping tablespoonfuls) in 3 gallons of water. It is commonly sold under its own name, or ready-mixed with one of the other sprays, such as bordeaux mixture or wettable sulphur, with which it is commonly used. *This poison should not be used except where washing will remove all spray or dust residues.*

Bordeaux mixture may be made at home as described on page 11. It may be purchased as a dry powder or paste under various proprietary names. If the label on the package states that the active ingredient is copper and that the material is for use on fruit trees, grapevines, potatoes, etc., the buyer may be certain that the contents are bordeaux, regardless of the proprietary name.

Lime-sulphur, a clear, amber-colored fluid, is used in winter at the rate of 1 pint to 1 gallon of water, and during the growing season at the rate of 1 pint in 5 gallons of water. It is sometimes sold in

the dry state. One-half pound of the dry material equals 1 pint of fluid.

Nicotine sulphate is useful in the control of sucking insects (plant lice or aphids). It is sold under various proprietary names and can be identified by the analysis on the label. It should be used as described on page 11.

Oil emulsion and miscible oils are sold under various trade names and can be identified by reading the labels. These oils and emulsions are useful in the control of scale insects, and should be applied only when the trees are wholly dormant.

Wettable sulphur is sold under a variety of trade names and can usually be identified by the word "sulphur" in the analysis given on the label, but it should not be confused with lime-sulphur, which is either a clear amber fluid or a powder that forms such a fluid when mixed with water. Wettable sulphur mixed with water forms a white to cream-colored or yellowish fluid. It should be used at the rate of about one-half pound to 5 gallons of water, or as directed on the package.

Sulphur dust is a specially prepared, finely ground sulphur which may be bought by itself and mixed with arsenate of lead at the rate of 9 parts of sulphur to 1 part of the arsenate of lead when needed, or the two may sometimes be bought ready mixed.

Copper-lime dust may be used in place of the bordeaux-mixture spray but is generally not as effective as the spray. It may be bought ready-mixed and with or without arsenate of lead.

#### STOMACH POISONS

##### *Paris green*

Spray:	
Paris green.....	2 level teaspoons
Hydrated lime.....	6 level teaspoons
Water.....	1 gallon
	} or { $\frac{2}{3}$ pound
	2 pounds
	50 gallons
Dust:	
Paris green.....	1 level teaspoon
Hydrated lime or flour.....	1 pint
	} or { 1 pound
	12 pounds

##### *Calcium arsenate*

Spray:	
Calcium arsenate.....	6 level teaspoons
Hydrated lime.....	12 level teaspoons
Water.....	1 gallon
	} or { 1 pound
	2 pounds
	50 gallons
Dust:	
Calcium arsenate.....	2 level teaspoons
Hydrated lime or flour.....	1 pint
	} or { 1 pound
	7 pounds

##### *Poisoned-bran bait*

Paris green.....	2 level teaspoons
Wheat bran.....	5 pounds
Molasses.....	$\frac{1}{2}$ pint
Water.....	5 quarts

Mix the paris green and dry wheat bran together so that every particle of the bran will receive a coating of the paris green. Dissolve the molasses in the water. Add the liquid to the dry materials slowly and mix thoroughly, making a rather dry mash.

Scatter the bait thinly, about sundown, near plants to be protected. The worms crawl out at night and eat the poisoned bran. If the garden is to be planted where heavy vegetation grew last fall, it would be advisable to scatter bait over the entire garden just before planting.

## CONTACT POISONS

*Nicotine sulphate*

Spray:		
Nicotine sulphate (40 percent nicotine)---	1 teaspoon	} or { $\frac{3}{4}$ pint 3 pounds 50 gallons
Soap, any kind-----	1 cubic inch	
Water-----	1 gallon	
Dust:		
Nicotine sulphate (40-percent nicotine)---	1 ounce	} or { $3\frac{3}{4}$ pounds 50 pounds
Hydrated lime-----	2 pints	

Nicotine dust is most effective if applied when the air is still and the temperature high, preferably above 75° F. Nicotine dust must be very thoroughly mixed in order to secure a uniform blending of the ingredients and must be applied as soon as mixed or kept in a tight container to prevent the loss of the nicotine.

## FUNGICIDES (FOR DISEASE CONTROL)

*Bordeaux mixture*

Pulverized bluestone (copper sulphate) -----	4 level tablespoons or 4 pounds
Water -----	2 quarts or 25 gallons
Hydrated lime -----	6 level tablespoons or 6 pounds
Water -----	2 quarts or 25 gallons

Dissolve the pulverized bluestone in the water in an earthen or wooden vessel. (Bluestone is corrosive to some metals, particularly iron.) Place the hydrated lime in the second portion of water and stir it; then pour the bluestone solution into the limewater while stirring.

Bordeaux mixture should be made fresh for each application. If old bordeaux is applied it may cause injury to plants and result in unsatisfactory disease or insect control.

## COMBINATION INSECTICIDES AND FUNGICIDES

Certain combination dusts and sprays may be made and thus control both insects and diseases at one application. For example, arsenical poisons may be added to bordeaux mixture, or both arsenicals and nicotine may be used in combination with bordeaux. To each 3 gallons of bordeaux 1 ounce of calcium arsenate or magnesium arsenate, or three-fourths ounce of paris green may be added. This gives a spray that will control certain leaf diseases and also the insects that eat the foliage. Bordeaux mixture is in itself a repellent for certain insects, and by the addition of 1 teaspoonful of nicotine sulphate to each gallon of bordeaux mixture, reasonable control of leaf hoppers and aphids can be secured in addition to the control of leaf blight.<sup>1</sup>

<sup>1</sup>For more detailed information on the control of garden diseases and insects consult Farmers' Bulletin No. 1371, Diseases and Insects of Garden Vegetables.

## CULTURAL PRACTICES FOR VEGETABLE CROPS

The following brief discussion of cultural practices is intended to cover only the main points in the growing of the various crops. More detailed information can be procured from the bulletins of the United States Department of Agriculture listed at the end of this bulletin. The workers in many of the State colleges and experiment stations have prepared special bulletins containing information especially adapted to those particular States, and subsistence gardeners are advised to write to the extension service of their State college for copies of these bulletins. Success depends largely upon the enthusiasm of the gardener and the painstaking care that he is willing to give his garden or fruit plantings. As already stated, much of the work of the small subsistence farms will be undertaken under difficulties, and no one should become discouraged if he does not attain complete success from the very start.

In the treatment of the crops in this bulletin, those belonging to the vegetable group are handled from the standpoint of the time of planting them in the spring rather than by alphabetical or any group arrangement. It should be borne in mind that the date for planting these crops varies with locality and elevation above sea level. Certain crops, such as potatoes, peas, cabbage, onions, kale, spinach, and lettuce, may be planted before the ground becomes warm or the danger of frost is past; others, such as snap beans, tomatoes, and sweet corn should not be planted until practically all danger of frost is past. Lima beans, peppers, and eggplant should not be planted until the ground has become warm. Wherever there are experienced gardeners in the neighborhood, their advice both as to the time and methods of planting should be sought.

## POTATOES

Potatoes are among the most important of the vegetable crops from a food standpoint. For a family of 4 or 5 persons, 10 to 15 bushels are required for the entire year. In the more southern sections a portion of the potato supply can be obtained from sweetpotatoes. Three to five bushels of early potatoes are considered enough for the average family, as early potatoes do not keep long and a late crop is better for winter storage. There are two main varieties of early potatoes, the Irish Cobbler and the Triumph, sometimes called Bliss Triumph.

Potatoes can generally be planted just as soon as the ground is in condition to work because they require from 4 to 6 weeks to come up. This, in many sections of the Northeast, may be as early as March 20; however, the first week in April is considered the time for planting early potatoes in many sections. To the northward the planting date may not be until the middle of May. One peck of seed potatoes will plant 300 to 400 feet of row, the potatoes being cut into pieces having 1 or 2 good eyes, as shown in figure 6. Under favorable conditions this will yield 3 to 5 bushels of potatoes suitable for home use. This will give a basis for calculating the quantity to plant. For a rather large family—6 or 7 persons—at least one-half bushel of seed should be planted for the early crop. By careful cutting of the potatoes this may be made to plant from 700 to 800 feet



of row. The seed should be planted in rows 3 feet apart, with the pieces 12 to 14 inches apart in the rows and covered 4 inches deep in light soils and  $2\frac{1}{2}$  to 3 inches deep in the heavier soils.

The greatest benefits from the use of fertilizer have been procured where it is drilled along both sides of the seed pieces and at about the same depth as the seed. The fertilizer should be kept at least 3 inches away from the seed pieces. One method of planting potatoes in the home garden is to open a flat-bottomed furrow about 4 inches deep and 8 inches wide. Place the seed pieces in the center and a trickle of fertilizer along each side; then, with the hoe, cover both the seed pieces and the fertilizer. This method will usually insure the best results.

Potatoes require no special cultivation except to be kept free from weeds and to be hilled up with soil as they develop in order to create a ridge in which the potatoes may form without being exposed to the

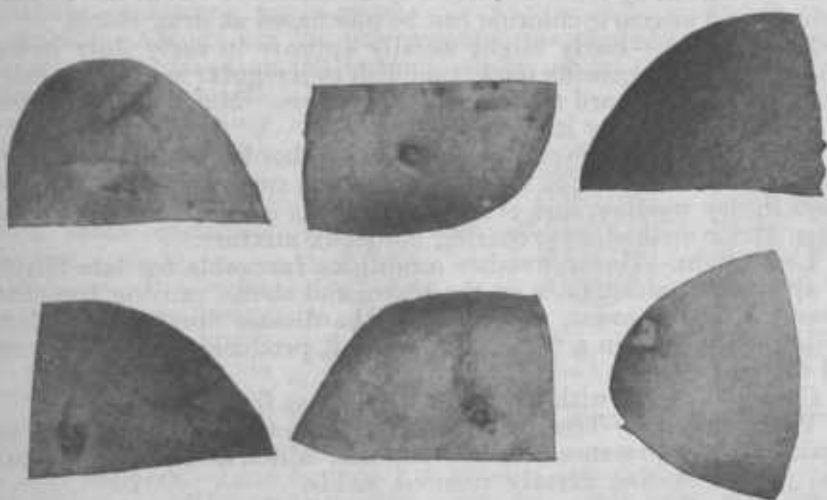


FIGURE 6.—Potato seed cut into chunky rather than thin wedge-shaped pieces.

light. Usually about four cultivations and as many hand hoeings are required. The work can be done entirely with the hoe, or where a horse is available a one-horse cultivator should be used.

Early potatoes may be dug about the time that the vines die or shortly afterward. Some of the potatoes may be dug for use while the vines are still fairly green, and in no case should the potatoes be left in the ground more than a week or 10 days after the vines are completely dead. When the potatoes are dug they should be exposed to the sun and wind for not more than 1 hour, and should then be stored in a cool, well-ventilated cellar or in an open shed where they will be cool but protected from the light. If stored in too large quantities or where they will not get air, the early potatoes are likely to rot.

Green Mountain, Russet Rurals, Jersey Red Skins, Irish Cobbler, and several other varieties are used for the main or late crop which produces the winter supply. These are grown in the same manner as early potatoes and as a rule are not dug until after frost has killed the vines. The late crop should be stored in cellars or some place where they can be kept at a temperature between  $50^{\circ}$  and  $60^{\circ}$  F.



## POTATO DISEASES

**Scab.**—Common scab is due to a disease organism that lives in the soil; it produces rough-pitted spots on the potatoes. The disease remains in the soil from year to year, and is also carried on the potatoes that are used for seed.

**Control.**—If possible, avoid planting on land that has produced scabby potatoes. Do not use badly scabbed potatoes for seed, and treat all seed potatoes just before cutting in a solution of formaldehyde or of mercuric chloride. Soak the seed 2 hours in formaldehyde solution (1 ounce in 2 gallons of water) or for 30 minutes in a solution of mercuric chloride made by dissolving the little coffin-shaped tablets at the rate of 1 to each pint of water. *The mercuric chloride should be used only in wooden or stoneware vessels. It is a deadly poison and must be kept away from children and all animals.* Both the formaldehyde and mercuric chloride can be purchased at drug stores.

**Early blight.**—Early blight usually appears in early July in the Northern States, causing dark, roundish to irregular spots with characteristic target-board markings on the leaves. Moist warm weather is most favorable for its development.

**Control.**—Spray the plants with a 4-6-50 bordeaux mixture, beginning when the disease is first seen. Repeat spraying every 10 to 14 days in dry weather, and every 7 to 10 days in moist weather. See page 11 for method of preparing bordeaux mixture.

**Late blight.**—Under weather conditions favorable for late blight, it appears in midsummer on the leaves and stems, causing irregular dead areas. In moist, cool weather the disease spreads very fast, killing the plants in a few days. Later it produces a brown rotting of the potatoes.

**Control.**—Spray with bordeaux mixture, as for early blight.

**Virus diseases.**—The so-called "running out" of potatoes is due mainly to the presence of virus diseases, which weaken and dwarf the plants, causing greatly reduced yields.

**Control.**—These diseases are carried with the seed and cannot be controlled by any form of seed treatment. The planting of seed potatoes that have been grown under inspection and that are sold under a State certification tag is the gardener's only safeguard against loss from virus diseases. It may be possible to secure seed potatoes that have not been grown under inspection and yet are reasonably free from virus diseases, but the use of seed that is certified by some official agency in the State where they are grown is the safest course to follow.

## INSECTS AFFECTING POTATOES

The most important insects that injure potato leaves and stems are Colorado potato beetles, leaf hoppers, flea beetles, and aphids (plant lice). The spray materials suggested in the following paragraphs to control the different pests can be combined to give an all-around spray. For the best results against leaf hoppers, bordeaux mixture should be applied about every 10 days from the time the plants are 6 inches high until harvest. When potato beetles or flea beetles are present, add a stomach poison; when aphids are present, add nicotine.

**Colorado potato beetles.**—The yellow and black striped Colorado potato beetles and their ugly brick-red slugs are known to every grower of potatoes, and are usually referred to as "potato bugs." (Fig. 7.)

**Control.**—The gardener with only a few potatoes can prevent serious injury from potato beetles by hand-picking or brushing off and killing the beetles. By examining the underside of the leaves the clusters of orange-colored eggs can be located and crushed. The hand-picking should be repeated at least twice a week. Fortunately, the greedy feeding of this insect makes it easy to control with an arsenical spray or dust. All portions of the plants should be covered with the poison. Either the paris green or the calcium arsenate formulas, when thoroughly and properly mixed, will give satisfactory results.

See page 10 for instructions on how to prepare spray and dust mixtures containing paris green.

**Aphids.**—Aphids are the tiny greenish- or pinkish-colored plant lice found clustered on the terminal shoots or on the underside of the leaves. These insects feed by sucking the plant juices and, when abundant enough, cause the leaves to curl, often enclosing the lice.

**Control.**—In order to control these insects it is necessary to apply a contact insecticide such as nicotine, when the air is still and the temperature high. Either the spray or the dust formula may be used.

**Leaf hoppers.**—Leaf hoppers are minute, active, greenish or yellowish insects. The adults possess wings and, upon being disturbed, fly readily, for short distances. The immature forms (called nymphs) when disturbed do not fly but scuttle rapidly over the surfaces of the leaves with a sidewise, crablike motion. Both adults and nymphs rest and feed mostly on the under surfaces of the leaves and thus escape notice, even though they may be present in large numbers. These tiny insects collect in potato fields during hot, dry seasons and produce hopperburn or tip blight. Hopperburn of potatoes appears as brown, and later as blackened, areas at the tips and borders of the leaves. This injury seriously interferes with the crop of tubers.

**Control.**—The most satisfactory remedy is a thorough application of bordeaux mixture, made according to the formula given on page 11.

**Flea beetles.**—Flea beetles, as the name implies, are small, dark-colored beetles which, when disturbed, jump away in a manner similar to that of a flea. They injure plants by gnawing small holes through the leaves, which often appear as though fine shot had been fired through them. The beetles usually feed from the underside



FIGURE 7.—Colorado potato beetle: a, Beetle; b, larva or "slug"; c, pupa. (Chittenden.)

of the leaves, which should be taken into account when sprays are applied.

*Control.*—The combination spray of bordeaux mixture and a poison, referred to in the first paragraph under potato insects, will give satisfactory control. Calcium arsenate dust or bordeaux mixture, used alone, will give some relief if applied when the beetles first appear and if repeated in about a week.

#### PEAS

Peas may be planted just as early in the spring as the ground can be worked. The rows should be 30 inches to 3 feet apart. A pint of seed peas will plant 100 feet of row. On light and sandy loam soils the seed peas should be covered about 2 inches deep; on clay and heavy soils 1 to 1½ inches is sufficient. There are several varieties of dwarf peas such as Little Marvel and Laxtonian which do not require supports. The Thomas Laxton and the Gradus are two of the standard varieties which grow 18 inches to 2 feet in height; the old-fashioned Telephone, which grows 3 to 5 feet in height, is an excellent late variety, but it must be provided with brush or wire supports. The Alaska and the Improved Alaska are extremely early sorts. These are what are termed smooth peas, that is, the seeds are not wrinkled. The quality of the smooth varieties is not quite equal to that of the wrinkled sorts. Peas that are left on the vines to ripen can be hulled and saved for seed. By planting three different varieties or by making successive plantings of the same variety a supply of peas for the table can be maintained over a period of 4 or 5 weeks. Fresh peas not required for immediate use may be canned, but peas are one of the most difficult of all vegetables to can.

#### PEA DISEASES

*Pod spot.*—Dark spots sometimes appear on the pods of peas. This trouble, called pod spot, is caused by an organism that also produces spots on the leaves and on the seed, in which it is carried from one season to the next.

*Control.*—There is no treatment for a diseased crop. The disease can be partially prevented by planting disease-free seed. The vines of a diseased crop should be gathered and burned.

#### INSECTS AFFECTING PEAS

*Pea aphids.*—Pea vines having made a good start are often checked and gradually wither, turn yellow, and in some cases shed their leaves. If the plants are shaken, small green aphids, no larger than the head of a common pin, fall to the ground. Upon closer examination the terminal shoots and leaves may be found crowded with either winged or wingless forms of these plant lice.

*Control.*—Nicotine dust or spray (p. 11) gives the most satisfactory control. The aphids can be beaten from the vines onto the ground by means of a brush of small twigs or a pine bough with the leaves left on. If the brushing is done on a hot, sunny day, when the weather is hot many are killed by the heat of the ground, and few, if any, ever return to the plants.

*Seed-corn maggot.*—See discussion under bean insects, page 31.

*Cutworms.*—See discussion under cabbage insects, page 22.

## ONIONS

Onions may be planted just as early as the ground can be worked; in fact, in many sections onions may be put in the ground during the fall and given slight protection during the winter. This is especially true of the multiplier or bunch onions. Standard varieties of onions like Prizetaker, Yellowglobe, Red Weathersfield, and Japanese may be grown from seed, from small southern-grown plants, or from the little onion sets which are sold in the stores. One to two quarts of onion sets will be needed to supply the onions required by the average family during the early part of the season. They should be planted in rows 18 inches apart with the sets 2 to 3 inches apart in the rows. The little sets should be placed right side up in a shallow furrow and covered with about 1 inch of soil. Onions are grown almost entirely by hand cultivation. When the onions approach maturity the soil should not be drawn around them; their ripening may be hastened by rolling an empty barrel over the row, or by breaking down the tops with the back of a hoe. This causes the onions to ripen uniformly, after which they may be pulled, dried, the tops removed, and the bulbs stored in a cool dry place. Onions require a very rich soil, and in addition to plenty of fertilizer being used before the plants or sets are planted, they should have at least one side dressing of fertilizer during the growing period. Where onions are grown from seed, the seed is drilled thinly in the rows and covered about 1 inch; then when the plants are about 2 inches high, they are thinned so as to stand  $1\frac{1}{2}$  inches apart. Sets are used for planting most of the onions grown in home gardens, but seed is used very largely for starting the commercial crop.

## ONION DISEASES

**Smut.**—Onion smut is caused by a disease organism that lives in the soil where smutted onions have grown. It produces blisters full of black powder on the leaves of young plants, killing them.

**Control.**—Where onions are grown from seed, sprinkle formaldehyde solution (1 teaspoonful to 1 quart of water) in the drill after the seed has been dropped, before covering them, using 3 to 4 quarts of the solution in each 100 feet of row.

**Mildew.**—Onion mildew may be noticed on the leaves on a dewy morning when a violet, furry covering may be seen on the surface. The leaves turn pale green and finally yellowish, and the diseased portions of the plants eventually collapse. The disease commonly starts in spots and spreads to surrounding areas.

**Control.**—Onion mildew usually appears in midseason and may be held in check by thorough cultivation and by spraying the foliage thoroughly with a 4-6-50 bordeaux mixture to which 3 pounds of rosin-fish-oil soap has been added as a sticker. (For full instructions for making bordeaux mixture see p. 11.)

## INSECTS ATTACKING ONIONS

The most common insect pests of onions are maggots and thrips.

**Onion maggot.**—The onion maggot is a small white maggot that bores through the underground portion of the onion, causing the plants to become flabby and turn yellow.

*Control.*—There is no control after the maggot has entered the bulb, but in gardens where onions are subject to injury, the young maggots can be killed before they enter the onions by pouring a bichloride of mercury solution, as suggested for the cabbage maggot (p. 23), along the row. Make the first application when the onions are about  $1\frac{1}{2}$  inches high, and repeat in about 5 days.

*Thrips.*—Thrips are tiny, elongated insects that feed underneath the leaf sheaths and produce mottled leaves.

*Control.*—Nicotine-soap spray as described on page 11 is suggested to control this pest.

#### LETTUCE

Lettuce is what most gardeners term a cool-weather crop, that is, it can be planted early in the spring while the weather is still fairly cool, and must be brought to maturity and used before hot weather sets in. This is especially true of head lettuce, and about the only way to grow good head lettuce in many sections is to start the plants in a hotbed or coldframe and transplant them to the open ground about as early in the spring as the soil can be worked. Good head lettuce of the Iceberg type can be grown almost anywhere if the plants are started early enough so that the heads will form before hot weather. The type of soil is not very important so long as it is rich and contains plenty of organic matter to hold moisture; in fact, almost any good garden soil will grow lettuce if it is properly enriched. Composted manure and commercial fertilizers may both be used to advantage. Lettuce plants grown indoors and transplanted should never be set in a furrow but always on a slight ridge or bed where they will get excellent drainage. Under no circumstances should the soil be hilled up around the lettuce plants. The plants of the larger varieties of head lettuce should be set in rows 15 to 18 inches apart and a foot apart in the row. When the seed is planted directly in the rows where the plants are to grow they should be thinned so as to stand at least 9 or 10 inches apart.

The main heading varieties that are grown in home gardens are New York (which is sold on the market under the name of Iceberg), Improved Big Boston (sometimes called "Unrivalled"), Mignonette (which is a small heading variety), and Hanson, another good heading variety. Certain varieties of nonheading or loose-leaf lettuce, such as Early Curled Simpson, Black Seeded Simpson, and Grand Rapids, will stand the heat of early summer somewhat better than the heading varieties, and so where plants of the heading varieties are planted for the early crop of lettuce, it is good practice to follow up with the planting of one of the loose-leaved sorts for later use.

Occasional side dressings of nitrate of soda or some other highly nitrogenous fertilizer will often aid very materially in hastening the development of the lettuce plants. Too liberal use of nitrogen, however, will cause the lettuce to be dark green in color, tough, and of a bitter flavor. Where the lettuce is watered during the growing period the water should be applied around the roots and not sprinkled over the top. Lettuce requires plenty of moisture, but on the other hand it will not grow on wet soil or on soil that is sour.

Two plantings of 50 plants each as a rule will be all that can be used by the average family during the time that lettuce is at its prime. If the seed is sown in the rows where the crop is to grow, the thinnings can often be used for the table and the plants that remain will develop large bunches or heads, depending upon the variety. A fall crop of lettuce can very often be grown, but the greatest demand for lettuce as a salad crop is in the spring.

#### LETTUCE DISEASES

**Drop.**—Lettuce is subject to attack by 2 or 3 diseases, including lettuce drop, which is caused by a fungus that attacks the lettuce plants near the base and causes them to wilt and later to become slimy and drop to the ground.

**Control.**—The remedy for this disease is to plant the lettuce on ground where the disease has not made its appearance. Where the drop disease occurs, the pouring of a weak solution of formaldehyde on the spot where the affected heads are removed will sometimes kill the hard spore masses that remain in the soil to perpetuate the disease.

**Rot.**—Head lettuce that is approaching maturity is especially subject to a rot that attacks the lower portion of the heads.

**Control.**—This trouble can be largely avoided by careful watering and by keeping the soil pulled away from the lower portions of the heads.

**Tipburn.**—Tipburn is what is commonly called a physiological disease and results mostly from high temperature after the heads are formed. It consists of a burning of the edges of the leaves and frequently extends throughout the entire head, causing its complete loss.

**Control.**—The maturing of the heads and their use before hot weather is about the only way to avoid tipburning. The use of chemicals in the form of sprays and dusts is of little value in the control of lettuce diseases.

#### INSECTS AFFECTING LETTUCE

Lettuce is attacked principally by springtails, cutworms, and aphids.

**Springtails.**—The name "springtail" is derived from the fact that these insects possess a springlike abdominal appendage that projects forward along the underside of the body. When disturbed, the insect extends this appendage, which enables it to jump. The springtails feed on decaying vegetation and seedling plants. They require a certain degree of moisture in order to thrive.

**Control.**—Dusting the affected area with hydrated lime will prevent damage.

**Cutworms.**—See discussion on cutworms under Cabbage, page 23.

**Aphids.**—Aphids or plant lice very frequently attack lettuce plants that are grown in the house or coldframe. These insects may be controlled by dusting the plants with nicotine dust. For preparation of nicotine dust see page 11.

## RADISHES

Radishes can be planted early; they grow quickly and constitute a very appetizing fresh food early in the season when such foods are rather scarce. Twenty-five or thirty feet of row will be enough for the average family. The little Scarlet Globe variety, also the variety known as French Breakfast, has been known to be ready for use in less than 20 days after planting. White Icicle, Lady Finger, White Strasburg, Long Scarlet Short Top, and Cincinnati Market are some of the leading varieties of second-early or summer radishes. One packet each of 2 or 3 varieties may be planted at about the same time, but they will come to maturity at intervals and will provide fresh radishes over a period of 4 or 5 weeks.

Radishes require a fairly rich soil. They should be planted in rows 18 inches apart, and the plants should be thinned to stand at least  $1\frac{1}{2}$  or 2 inches apart in the rows. The seed should be covered about three-fourths of an inch deep in loam soils, but not more than one-half inch deep in clay soils. Very little cultivation is required because the season of growth is so short. They are soon gone, and some later crop can be planted after them.

In order to save seed of radishes, select a few of the best and simply leave them in the ground to mature and go to seed. When the seed pods are beginning to turn brown, the entire top can be cut off and spread on a sheet to dry, after which the seeds can be beaten out of the pods with a stick, and then cleaned and stored for planting the next year.

## RADISH DISEASES AND PESTS

Radishes, as grown in the home garden, are not seriously affected by either diseases or insect pests.

## CABBAGE

Cabbage is native to the cooler sections of Europe. It thrives best during the winter and early spring in the South and during the cool portions of the summer in the northern part of the country. There are very distinct early, medium, and late varieties of cabbage. Those of the Jersey Wakefield and Charleston Wakefield type, which have rather small pointed heads, are considered best for early planting, and 25 to 50 plants will produce all of the early cabbage that can be consumed by the average family during the early part of the season. For fall and winter use 100 to 200 plants of a good late variety such as Late Flat Dutch, All Seasons, or Danish Ballhead should be planted. On soils where the cabbage yellows disease is present, one of the resistant strains, such as Wisconsin Hollander, should be planted for the late crop.

The plants for the early crop must be started indoors, or southern-grown plants may be purchased. The plants for the late crop can be grown out-of-doors, as it is not necessary to set them in the garden before the middle of June, or the first of July in many sections. If the cabbage is planted too early the heads will form in advance of cool fall weather, and they will burst and be a loss. The ideal way is to time the planting of the late cabbage so that the heads will reach



their maximum size and solid texture about the time that the first heavy frosts or light freezing weather occur in the fall. This will give the best crop of cabbage for storage. Cabbage requires a very rich soil, also one that does not dry out rapidly but is well drained and easily worked. In planting the early crop when the soil is likely to be a trifle wet, it is a good idea to place the plants on slight ridges, the rows being 30 to 36 inches apart and the plants 12 to 15 inches apart in the rows. For the late crop the rows should be 36 to 42 inches apart and the plants set 18 inches apart in the rows.

Side dressings of highly nitrogenous fertilizers will greatly stimulate the growth of the cabbage; the use of too much nitrogen, however, will produce either solid heads that will burst before they can be used or loosely grown heads that are not especially desirable for storing. In setting cabbage plants it is always desirable to pour a little water around the roots of each plant as it is being set, to insure the plants taking hold and getting a quick start. Cabbage is one of the easiest of the garden vegetables to grow as it requires only 2 or 3 cultivations and 1 or 2 hand hoeings. It is also one of the most desirable of the garden vegetables from the standpoint of vitamin and mineral-salt content.

Cabbage may be stored in cool cellars or buried out-of-doors. Slight freezing in the pit does not materially damage the heads; however, if the freezing is too severe it will cause the cabbage to soften and rot.

In many sections a crop of late cabbage can be grown on the same ground where early peas, spinach, or lettuce have been produced. In other localities late cabbage is planted between the rows of early potatoes.



FIGURE 8.—Cabbage plant with large knotted roots caused by clubroot.

#### CABBAGE DISEASES

**Clubroot.**—Clubroot of cabbage causes large irregular swellings on the roots, as shown in figure 8. Diseased plants are stunted, have a sickly yellow appearance, and often wilt during the heat of the day. The trouble may attack the plants in the seed bed, or after they are set out.

**Control.**—Avoid planting any of the cabbage family on land where clubroot has occurred in any of several previous years. If rotation is not possible, apply lime, preferably hydrated, at the rate of 25 pounds per square rod, working it into the soil several months before planting. See that only healthy plants are planted.



**Yellows or wilt.**—Cabbage plants attacked by yellows are stunted, turn a yellowish-green, and the lower leaves fall off. Often one-sided plants are found, or one side of the leaf may be yellow and the other side green. Figure 9 shows a cabbage plant that is affected by the yellow disease.

**Control.**—Practice crop rotation when possible. The surest means of control consists in the use of seed of yellows-resistant varieties, several of which are now handled by a number of seedsmen. The yel-



FIGURE 9.—Cabbage plant stunted and leaves curled by yellows.

lows-resistant Wisconsin Hollander is a late cabbage; while Wisconsin All Seasons and Wisconsin Brunswick are flat types, somewhat earlier and especially suitable for making sauerkraut. Resistant midseason strains, Marion Market, Globe, All Head Select, and an early strain, Jersey Queen, are now available from a few seedsmen.

**Black rot.**—Plants attacked by black rot usually have yellowed leaves with areas on the edges showing blackened veins, and the insides of the stems show a black ring. Diseased heads often rot in the field or in storage.

**Control.**—Pull and burn affected plants as soon as they are noticed. A long rotation in which neither cabbage nor related plants are allowed to grow on infested land is very important. Disinfect seed in mercuric chloride (see scab of potatoes) 30 minutes, then rinse in clear water. Plant in seed-bed soil known to be free of black rot.

**Blackleg.**—Blackleg attacks cabbage plants while they are very small, often in the seed bed.

Blackleg is caused by an organism that produces a blackening and rotting of the stem at about the soil line and on the leaves dark spots in which tiny black pimples appear. The leaves often turn purple; later the whole plant wilts so the tips of the leaves rest on the ground. The disease is carried on the seed, and may be spread by water spattering on the leaves during sprinkling or during rainstorms.

**Control.**—Disinfect seed as for black rot. Pull and burn diseased plants as soon as seen. Water cautiously to avoid wetting the leaves.

#### INSECTS AFFECTING CABBAGE

The principal cabbage pests are cabbage worms, aphids, the cabbage maggot, and cutworms.

**Cabbage worms.**—There are several kinds of caterpillars that often feed on cabbage and related plants. The common cabbage worm is about  $1\frac{1}{4}$  inches long when full grown and of a velvety green appearance. It is the young of the white butterfly which has black spots on its wings. When abundant, these worms feed so heavily upon the heads of cabbage, cauliflower, and other leafy vegetables that the infested plants are stunted and some of them are rendered unfit for food. The cabbage looper is similar in size and habits to the common cabbage worm just described. The larva of the diamond-back moth is another important cabbage pest; this worm is much smaller than the other two.

**Control.**—Paris green or calcium arsenate sprays or dusts (see formula, p. 10), may be used on cabbage until the heads begin to form, but, because of a poisonous residue, must not be applied too near harvest. After the heads begin to form, other materials should be used for control. Satisfactory results have been obtained by using derris dust containing from three-fourths to 1 percent of rotenone. Pyrethrum dusts and extracts are also effective.

**Aphids.**—Cabbage plants in seed beds and at later stages of their growth are sometimes covered with clusters of whitish-green plant lice, about the size of small birdshot. These aphids suck the sap from the leaves, and such affected leaves curl and crinkle or form cups, completely lined with the aphids. If the injury is severe, the plants wilt and die. If the plants are not killed by the aphids they are often dwarfed, grow slowly, and form small, light heads.

**Control.**—The most satisfactory method of combating this pest is by spraying with nicotine and soap solution or dusting with nicotine dust (p. 11).

**Cabbage maggot.**—Frequently cabbage plants in the plant bed or in the garden apparently stop growing, and the leaves change to a bluish-green color. If one of these plants is pulled, the rootstocks will be full of mines in which a small white maggot may be found. This maggot comes from a small fly which lays its eggs on the stem at the soil line.

**Control.**—If a small tar-paper disk is slit from one side, laid flat on the ground, and fitted snugly around the plant at the time the plant is set in the garden, egg laying will be prevented. There is no satisfactory control after the maggots have entered the rootstocks, but one-half cup of bichloride of mercury solution (1 to 1,000) poured around each plant will kill the newly hatched larvae. Make the first application about 4 days after setting the plants and repeat in 10 days. Coffin-shaped tablets containing 7.3 grains of bichloride of mercury can be purchased at drug stores, and one tablet dissolved in a pint of water gives a 1 to 1,000 solution. One ounce of bichloride of mercury dissolved in  $7\frac{1}{2}$  gallons of water also gives the desired strength. Bichloride of mercury is extremely poisonous and must be handled carefully. It also corrodes or attacks most metals so should be dissolved and handled in earthen or glass containers.

**Cutworms.**—There is perhaps no other group of insects so generally destructive to garden crops as cutworms. Their habit of cutting off young plants at or near the soil surface at night and hiding under the soil at or near the base of the plant by day is well known.

Although there are many different kinds of cutworms, varying greatly in appearance and life habits, the following life cycle is fairly typical of the entire cutworm group injurious to garden crops: The adults are dull-brown night-flying moths or millers that are frequently attracted to lights during the summer months. The moths are seldom seen during the day. The eggs are deposited on vegetation or in the soil of weedy or sodded areas during the late summer. The tiny cutworms hatching from the eggs a few days later feed on vegetation until cold weather, when they burrow deep into the soil to pass the winter. In the spring the partially mature worms come to the surface with a greedy appetite brought about by the all-winter fast and are ready to destroy the first succulent garden plants to appear in the spring. The worms complete their growth by early summer, burrow several inches in the soil, and change to moths. Some cutworms vary considerably from this life cycle.

*Control.*—(1) Since the moths select weedy or sodded areas for egg laying in late summer, gardens kept cleanly cultivated during the egg-laying season are less likely to attract the moths. (2) Fall and winter spading or plowing, where practicable, will turn many of the immature worms up to the attack of weather and other natural enemies. (3) In small gardens cutworms can usually be collected and killed at the base of the plant they have cut down. (4) The surest method of protecting plants from cutworm attack is to use poison bran mash, made as described on page 10.

Where a comparatively small number of cabbage plants are being set in the home garden they may be protected from cutworms by placing a band of rather stiff paper or very light cardboard completely around the stem of each plant. These bands should fit rather closely around the stems and extend 1 inch below the ground and about 2 inches above ground. By cutting the paper in 3-inch squares and rolling around a lead pencil it is easy to place the bands around the stems of the cabbage plants as they are being set in the ground.

#### KALE

Kale belongs to the cabbage group and requires practically the same soil and cultural conditions as cabbage. In all of the warmer sections of the country kale can be planted on the top of the ridges in the fall of the year and will remain in the open ground all winter, producing a crop during the late winter or early spring.

The usual practice is to throw up ridges about 6 or 8 inches in height and 3 feet apart; after leveling the ridges a trifle place a little pinch of seed at intervals of 12 or 14 inches along the tops of the ridges. Later, when the plants appear, they may be thinned to 1 or 2 in a place. For spring planting the rows should be made about 3 feet apart and nearly level. The seed can be sown thinly in a drill and the plants thinned. The curled Siberian is one of the most common and best varieties. Kale will not stand any great amount of heat and is at its best when grown as a late fall or early spring vegetable.

#### KALE DISEASES

*Control.*—Same as for cabbage diseases.

## INSECTS AFFECTING KALE

The only pest of kale that is economically important is the turnip aphid. This pest has already been discussed under Cabbage.

## SPINACH

Spinach is perhaps the most important of the spring and late-fall greens, although in northern sections it can be grown during the entire summer and in southern sections throughout the winter. In the intermediate sections spinach can be planted as early in the spring as the ground can be conveniently worked, and also late in the summer for a fall crop. Spinach will be ready for use in 6 to 10 weeks after it is planted. In the southern sections spinach can be sown during October and November and will be available for use the entire winter. The usual method is to throw up beds about 5 or 6 feet in width and plant 5 to 7 rows of spinach on each bed, or in some cases the seed is sown broadcast on the beds. For spring planting and where bedding is not essential for drainage, spinach can be planted on level ground in rows usually spaced from 9 to 12 inches apart; about 15 seeds are sown to the foot. As a rule this will be a little too thick for the plants to grow, but the earliest plants can be thinned out and used, thus making more room for the rest.

Spinach will not thrive well on extremely sour soil, and where the soil is sour lime should be used moderately, about 3 pounds on each 100 square feet of surface. For spring planting use the variety known as Longstanding or Bloomsdale Savoy; for fall planting use the Norfolk Savoy, which is a blight-resistant variety that stands the winters better than the common Savoy.

The secret of having plenty of spinach for use is to make several seedlings beginning just as early as possible in the spring, plant every 2 weeks until midsummer, and then make several fall plantings beginning about the first of September. In the extreme northern part of the country the plantings can be made at intervals of about every 30 days throughout the spring and summer.

## SPINACH DISEASES

**Blight.**—Spinach blight appears first as a mottling of the young inner leaves. They later change to a yellow color and are finally killed. The disease gradually spreads to the outer leaves, which in turn are changed to yellow. As the disease progresses and before there is any killing, the leaves curl and wrinkle.

**Control.**—Plant seed of the Norfolk Savoy variety, which resists the disease. Maintain vigorous plants by thorough cultivation and give a liberal application of fertilizers. Plant on well-drained soil.

## INSECTS AFFECTING SPINACH

**Spinach aphid.**—The principal insect pest of spinach is the spinach aphid. The young aphids are pale yellowish green with three dark lines on the back of the abdomen.

**Control.**—The control measures for this aphid are the same as for the other aphids already discussed, that is, spraying or dusting with a strong contact insecticide such as that recommended for aphids on cabbage.

## CARROTS

The carrot is considered one of the best of the early vegetables from the standpoint of its food and vitamin value. The seed can be planted as soon as the ground becomes slightly warm. The rows should be spaced about 18 inches apart and 30 to 40 seeds planted to each foot of row. The seeds should be covered not more than half an inch in light loamy soils and a trifle less in the heavy clay soils. After the plants are up they must be thinned to 6 or 8 to a foot, but it is necessary to have a much larger number of plants to begin with, in order that the little seedlings may push through the surface. It is very important that the plants should be thinned just as soon as they are large enough to handle.

Carrots require a deep, rich, loose soil containing an abundance of organic matter so as to hold a reasonable amount of moisture. The crop requires frequent hoeing and hand weeding, in order to keep the rows free of grass and other weeds that have a tendency to smother them. It is good practice to make two plantings during the early part of the season, about 4 weeks apart, as the second or later planting usually produces a better grade of carrots for storage purposes.

The variety known as Chantenay is perhaps the most universally grown, although there are a number of excellent varieties, such as Early Rubicon, Danvers Half Long, and Coreless. The fresh carrots can be used direct from the garden during the entire summer; then in the fall as cold weather approaches all that remain may be pulled and stored in an outdoor pit or packed in moist sand in a cool cellar. Before the carrots are stored the tops should be cut off about half an inch above the roots.

## CARROT DISEASES

Carrots, as grown in the home garden, are remarkably free from diseases, and where the plants are properly thinned and cultivated attention need rarely be paid to carrot diseases.

## INSECTS AFFECTING CARROTS

Carrots are comparatively free from insect pests, and in ordinary gardens they do not require protection from insects. The foliage of carrots is sometimes damaged by a rather large, highly colored green and yellow worm, but hand picking these worms when they appear is usually effective.

## BEETS

The beet is another of the garden vegetables or root crops that is of high food value, and may be planted in rows 18 inches apart, or about the same as for carrots. Beets require a rich, well-drained soil; however, they do not go as deeply into the soil as carrots and several other of the root crops. About 1 ounce of seed will be an abundance for the home garden, and this should be planted rather sparingly as each of the seed balls may contain 2 or 3 individual seeds. For that reason about 8 or 10 of the seed balls are planted in each foot of row; 100 feet of row will usually provide enough beets for the average family. The seeds should be covered about half

an inch deep on light soils and a trifle less on heavy soils. The plants should be thinned to stand at least 3 inches apart, although they can be left somewhat irregular in the row and in that way about 6 plants can be left to the foot of row. The young tender thinnings make excellent greens. Crosby's Egyptian, Detroit Dark Red, and Eclipse are among the leading varieties for planting in the home garden. Some gardeners follow the practice of making two plantings as with carrots. This provides an extra supply for late summer and for storage.

#### DISEASES OF BEETS

Garden beets are often injured by cercospora leaf-spot disease which consists of numerous small round or irregular dead spots with white centers and purple borders appearing on the leaves. They are caused by a fungus that attacks both beets and Swiss chard, often causing the leaves to curl, dry up, and die. The treatment for this disease is to spray the beets with a 4-6-50 bordeaux mixture when the first spots are observed, and for complete control repeat the spraying every 10 days.

#### INSECTS AFFECTING BEETS

The principal insect pests of beets are blister beetles and flea beetles.

**Blister beetles.**—Sometimes beet leaves are stripped, and only the midribs are left. The damage is caused by beetles almost three-quarters of an inch long. These beetles may be black, gray, or striped.

**Control.**—As the name indicates, blister beetles are irritating to tender skin, and precautions should be taken when hand picking for control is practiced. The beetles can also be killed by being brushed into a pail containing water to which a little kerosene has been added.

**Flea beetles.**—Flea beetles are tiny, active jumping beetles which eat small circular holes in the leaves.

**Control.**—The method of control is the same as that for the potato-flea beetle (p. 15).

#### SWISS CHARD

Swiss chard is similar to the garden beet in its habit of growth, except that it grows almost entirely to tops and does not form an enlarged root. The stems and tender leaves make most excellent summer greens, being cooked exactly as beet or other greens. Swiss chard withstands the heat of summer better than spinach, mustard, and other crops that are usually grown for greens. The variety known as Lucullus is considered the best. The planting and culture are exactly the same as for beets, except that the plants should stand approximately 6 inches apart in the rows. If desired, the seed can be sown in a seed bed and the plants transplanted. If the seed is sown where the plants are to remain, the plants may be thinned and the thinnings used as greens. All but the very hearts of the remaining plants may be cut or pulled frequently for greens and the plants will put on a new growth. Swiss chard is not easily injured by cold and may often be used in the fall after frost. The tender leaves and leaf stems are used for food.

## DISEASES OF CHARD

Cereospora or leaf spot is often severe on Swiss chard in some localities. Spraying with bordeaux mixture for its control is impractical because the spray residue makes the leaves unfit for food. Severe cutting back together with cultivating, watering, and fertilizing will usually result in new growth free from the leaf spot.

## INSECTS AFFECTING SWISS CHARD

Swiss chard is sometimes attacked by blister beetles. These are easily recognized, as they are long and noticeably slender, with black, gray, or striped bodies. On Swiss chard they can best be controlled by hand picking. Foliage that is damaged by blister beetle should be cut off and discarded and new foliage will form.

## PARSNIPS

The parsnip is adapted for growing throughout the northern portion of the United States. Any deep fertile soil will grow parsnips, but it should be spaded or plowed to a depth of at least a foot and enriched with fine well-rotted manure and commercial fertilizer. A shallow, stony, or lumpy soil is inclined to produce rough, prongy roots. Coarse manure should not come in direct contact with the roots for the same reason.

Parsnips should be planted in rows 18 to 24 inches apart, and the seed should not be sown until the ground is fairly warm. Only fresh parsnip seed should be planted, as the seeds are practically worthless if kept over until the second year. Hollow Crown and Guernsey are good varieties. The plants should be thinned to stand about 3 inches apart in the rows. Cultivation methods are the same as those recommended for beets and carrots.

Parsnips may be dug and stored in a cellar in moist sand, or they may be left in the ground until they are used. Roots placed in cold storage gain in quality, and freezing in the ground in the winter also improves the quality.

Parsnips as grown in the subsistence garden are not subject to any serious diseases or attacks by insects.

## SALSIFY

Salsify, sometimes called oyster plant, can be grown in practically the same manner as parsnips. The roots may be dug and stored in the cellar, or they may remain in the ground until wanted for use. Salsify has no special disease or insect enemies as grown in the subsistence garden.

## BEANS

Beans are among the best foods grown in home gardens. They are divided into 3 or 4 groups; the snap or bunch beans that are used fresh from the garden or are canned for winter use, the dry beans, and lima beans. In addition, there are the so-called black-eyed peas and chowder peas which are used the same as beans.

There are two types of snap beans, the green podded and the wax podded, and each of these is divided into the flat-podded and the round-podded types. Stringless Greenpod is one of the leading



round-podded green snap beans. It matures in 50 to 53 days after planting. Recently, a new round-podded bean has appeared under the name of Tendergreen. It is claimed that it will mature in about 53 days after planting. Bountiful, a flat-podded green variety, matures in 48 or 50 days and is a very popular variety for the home garden. Among the wax-podded bush beans, Pencil Pod Wax, which matures in about 52 days, is one of the most desirable for the home garden. Another good wax bean is the Round Pod Kidney Wax. Among the early pole beans which may be used either as green beans or as dry beans Kentucky Wonder, or Old Homestead, as it is sometimes called, stands at the head of the list. In the lima bean group are two classes, the dwarf and the pole. The baby lima or Henderson's Bush is one of the best for southern and central locations, because it stands the heat of summer so well. However, the beans of this variety are quite small, and many people prefer to grow the Fordhook Bush lima, which is sometimes called potato lima and has extra-large plump beans of very fine quality. Among the pole limas the King of the Garden is one of the best. The bush limas as a rule will mature in 75 to 80 days, whereas the pole limas require about 90 days.

Bunch or snap beans should be planted in rows at least 30 inches apart and the hills 15 to 18 inches apart in the rows, with 3 or 4 plants in each hill. The bush lima beans require a little more space than the bunch snap beans; the rows should, as a rule, be 36 inches apart and the hills 18 to 20 inches apart in the rows. For the large-growing pole beans like Kentucky Wonder and the pole lima the hills should be placed about 3 by 4 feet. Three plants of the Kentucky Wonder may be left in the hill to climb on a single pole, but not more than two plants of the large-growing pole lima should be allowed to each pole, and one plant is really better. One method of planting pole lima beans is to place the hills in the form of a triangle, and then fasten the three poles together at the top, Indian-wigwam fashion, and allow one plant to each pole. By this method the poles do not have to be set in the ground more than 5 or 6 inches, but where the poles stand alone they should be set at least 15 inches deep in order that they may stand up with the load of bean vines upon them.

Bunch or snap beans require a fairly rich soil, but the application of too much fertilizer will often cause them to grow excessive tops and put on comparatively few beans. With lima beans, especially the pole lima, there is little danger of getting the soil too rich. Snap beans may be planted about the time that the last spring frosts occur. On light and loamy soils the seeds should be planted about an inch deep, but on heavy clay soils, or where the soil is fairly wet at the time of planting, the seeds should be covered not more than one-half an inch. As a matter of fact, if they are scarcely covered at all they will come up to better advantage. In the case of lima beans it is customary to take each seed between the thumb and finger and thrust it eye downward into the soil, and where the soil is the least dry they should be covered deep enough to reach moisture. In the average home garden it is a good plan to have a few of each kind of beans in order to give variety and maintain a continuous supply. One or two plantings of lima beans will be suffi-



cient, but with the snap beans it is a good plan to make a planting about every 2 or 3 weeks; however, 50 to 60 feet of row will be an abundance for planting at any one time. If soil conditions are right it is easy to get a stand of snap beans. Lima beans are especially susceptible to cold and wet, and for that reason the seeds should not be planted until the ground is warm. Under no conditions should the seeds be put in the ground when it is excessively wet.

#### BEAN DISEASES

**Anthracnose.**—Anthracnose may be recognized on the pods by roundish sunken spots, with dark-brown or black borders and pink centers. It also produces elongated sunken, dark-red cankers on the stems and leaf veins, and grows through the pods, causing rusty looking spots on the ripe seed. The organism that causes this disease lives over winter in the seed and attacks the young seedlings. The disease is worst during moist, cool weather.

**Control.**—As anthracnose does not usually occur on bean seed grown in the States from Colorado west, it is best to buy western-grown seed if possible. Pull up and burn the first plants showing the disease. Do not cultivate, walk through, or pick beans when the vines are wet. To do so will spread the disease and make it worse. Wells Red Kidney, White Imperial, and Perry Marrow, all dry shell-bean types, are resistant to anthracnose and may be grown if dry shell beans are wanted.

**Blight.**—Bean blight causes irregular diseased areas on the leaves which at first are water-soaked, later become brown and brittle, and usually have pale yellow borders. It attacks the stems, producing reddish cankers. On the pods slightly raised watery pustules appear, which later enlarge and become irregular in shape and rusty in color. The disease is carried in the seed.

**Control.**—The same as for anthracnose. A few varieties of garden bush beans are somewhat resistant to the disease: Late Stringless Green Refugee, Refugee 1000-1, and Refugee Wax. Procure western-grown seed if possible.

#### INSECTS ATTACKING BEANS

The principal insect pests attacking beans are the Mexican bean beetle, the bean leaf hopper, the bean aphid, the seed-corn maggot, and the bean weevil.

**Mexican bean beetle.**—In many localities this insect is the worst pest of beans. The beetles are from one-fourth to one-third inch long, shaped like a split pea, and from yellow to coppery brown in color. On the back are 16 small black spots, forming three rows across the body, as shown in figure 10. In general appearance they resemble the beneficial lady beetles. The young of the beetles are yellow grubs with rows of branched spines on their backs. When full-grown these grubs are about one-third of an inch long. Both the beetles and larvae eat the bean leaves, and when they are very abundant they feed on the pods and stems.

**Control.**—In the home garden these insects can be controlled by hand picking provided the practice is started early and repeated often enough. Crushing the yellow egg clusters that may be found on the

underside of the leaves will also prevent a brood of larvae. From 2 to 2½ pounds of derris root powder containing 4 or 5 percent of rotenone in 50 gallons of water (or 2 to 2½ ounces in 3 gallons) is now recommended as the best control for this pest. Magnesium arsenate applied as a spray to the underside of the leaves is also an effective control, and magnesium arsenate dust applied to the underside of the leaves will give some relief. These materials can be prepared according to the following formulas:

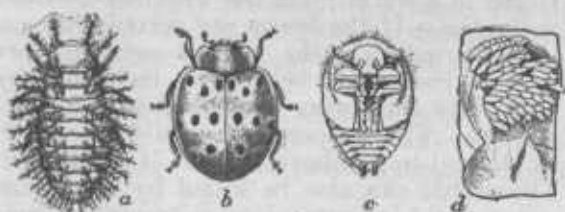


FIGURE 10.—The Mexican bean beetle: a, Larva; b, beetle; c, pupa; d, egg mass. About three times natural size.

#### Sprays:

Derris root powder	2 to 2½ ounces	} or {	2 to 2½ pounds
Water	3 gallons		50 gallons
Magnesium arsenate	2 level tablespoons	} or {	2 pounds
Water	1 gallon		50 gallons

#### Dust:

Magnesium arsenate	3 level tablespoons	} or {	1 pound
Hydrated lime or flour	1 pint		5 pounds

Magnesium arsenate should not be applied after the pods have begun to form. If applications of sprays are necessary after the first pods form, the derris root spray or a pyrethrum extract at the strength recommended by the manufacturer should be used. Paris green, calcium arsenate, or lead arsenate should not be used on beans at any time because they will injure the foliage.

**Leaf hoppers.**—These small, greenish-yellow, active insects suck the juice from bean foliage and prevent normal development.

**Control.**—Same as for leaf hoppers on potatoes, page 15.

**Aphids.**—Occasionally the terminal shoots of beans are covered with tiny black aphids (plant lice). These sap the vitality of the plant and prevent growth.

**Control.**—With nicotine, as recommended under Potatoes, page 15.

**Seed-corn maggot.**—Sometimes in wet seasons beans fail to come up or perish just as they come through the ground. If the seed is examined closely, small white maggots will be found causing the damage. The parent flies which lay the eggs that produce these maggots are attracted to decaying vegetation to deposit their eggs, and in wet seasons the maggots are able to crawl about and locate the germinating seed. In wet seasons beans should not be planted immediately after plowing or spading, especially if much vegetation has been turned under.

**Control.**—If possible, allow the vegetation to decay and the soil to dry before planting the seed. Keep manure out of the seed row. Planting should be shallow.

**Bean weevil.**—Seed beans or dry beans for table use are sometimes bored full of holes and are unfit for seed or food. This damage begins in the garden, where the parent weevil deposits a tiny egg inside the pod.

After the egg hatches the larva enters the bean and does not change to an adult until the beans are stored. When beans are stored in a warm place the weevils continue to reproduce.

*Control.*—If the beans are mixed with one-sixth of their weight of hydrated lime the weevils cannot reproduce in storage. The weevils inside the beans can be killed by heating. Spread the beans in a thin layer in a shallow pan and heat in an oven for 30 minutes. The temperature should be above 120° F. but should not be allowed to go above 135° F. if the beans are to be used for seed. The weevil can also be killed by suspending the beans in boiling water for 1 minute; longer treatment may prevent germination. The beans should be spread out and dried quickly after removal from the bath.

#### SWEET CORN

Sweet corn requires too much space for growing to any extent in the small garden. It is sometimes possible, however, to grow a small block of very early sweet corn, then follow it with late cabbage or with turnips. Where there is sufficient space, about 2 plantings of an early variety should be made, and 2 or possibly 3 plantings of a later variety. Sweet corn should not be planted until the ground is reasonably warm. It requires a rich soil, and the hills should be spaced about 3 by 4 feet, that is, if the rows are 4 feet apart the hills should be 3 feet apart in the rows. For the dwarf varieties like Golden Bantam the hills may be placed 3 by 3 feet with 3 stalks in a hill. The usual custom is to mark off the rows, then drop about 5 grains of the seed corn in each hill, and cover it with 1 to 1½ inches of soil. If more than 3 plants appear in a hill the extra ones are thinned out. Golden Bantam, Golden Cross Bantam, Whipple Early White, Howling Mob, and Mammoth White Cory are among the leading early varieties; Country Gentleman, Stowell Evergreen, and Golden Evergreen are among the leading medium and late varieties.

In planting sweet corn in the garden it should be borne in mind that the corn will not pollinate and the ears will fail to fill unless several rows are planted together; therefore, it is best to plant sweet corn in a block rather than in the form of a few long rows. Where the blocks of sweet corn can be placed side by side the first, second, and subsequent plantings can be located in a continuous section; in that way good results in the pollinating and filling of the ears will be obtained.

Corn requires from 3 to 5 cultivations, mainly to keep the ground free from weeds. Deep stirring of the soil toward the time of the maturity of the ears is not desirable because the roots of corn run near the surface and the deep stirring of the soil will break the feeding roots and check the growth of the corn. For best results sweet corn should be cooked and on the table within 2 hours after being pulled, as it loses in sugar content very rapidly after it is pulled from the stalk. Keeping the corn in a refrigerator at a temperature below 40° F. after it is pulled will largely prevent the loss of sugar.

## DISEASES OF SWEET CORN

As a rule sweet corn is not seriously troubled by diseases, but in certain sections there is a disease known as "Stuart's disease." In these sections resistant varieties are being developed and should be planted.

Sweet corn is frequently affected by smut on the ears, in the tassels, and on the stalks. Wherever the smut appears, the affected parts should be removed and burned immediately to prevent further spread of the disease.

## INSECTS AFFECTING SWEET CORN

There are two important insects that attack sweet corn—the European corn borer and the corn ear worm.

**European corn borer.**—The corn borer is a serious pest in sections of the country where it has become established. There is really very little that the home gardener can do to control the corn borer except to cut and destroy all cornstalks as soon as the ears have been removed. This will prevent the worms that are in the stalks from maturing and to some degree will hold the insect in check.

**Corn ear worms.**—This worm works mainly in the tips of the ears of corn but will sometimes eat its way to the middle or lower part of the ear. The eggs are laid on the young corn silks by a moth that flies at night. Dusting the young corn silks with arsenical poisons may kill some of the worms when they first hatch, but there is no remedy that is fully effective. This insect is also known as the tomato fruit worm (fig. 11).

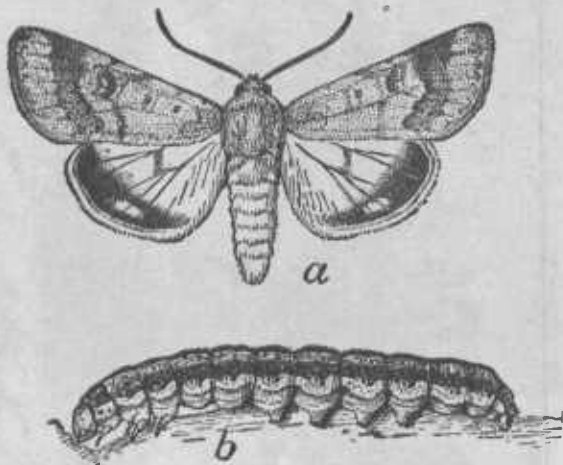


FIGURE 11.—Tomato fruit worm: a, Moth; b, full-grown fruit worm. (Chittenden.)

## TOMATOES

The tomato is a very important garden crop because of its vitamin content when eaten raw and its many desirable qualities when cooked or canned for winter. Plants for early tomatoes should be started indoors, but those for the main or late crop may be started in a cold-frame and in some sections in the open ground. For the average garden 25 to 50 early plants will be enough, but 50 to 100 or more late plants should be set to furnish plenty of tomatoes for canning. Two methods are used for growing the early crop. The method where the plants are set about 2 by 3 feet and trained to stakes has

much to recommend it, especially where garden space is limited. As the plants are set, after all danger of frost is past, a strong stake about 4 feet in height is driven alongside of each plant. As the plants grow, the side shoots are all removed while still quite small; and the main stem bearing 5 or 6 clusters of fruit is tied to the stake with strips of muslin or soft twine, as shown in figure 12. The other system consists of planting the tomatoes about 3 by 4 feet apart and allowing them to branch freely and to grow naturally on the ground.



FIGURE 12.—Training tomatoes to stakes: A, Cutting out the side shoots or branches; B, tying the main stem to the supporting stake.

The late or main crop of tomatoes is usually planted in rows 4 feet apart, with the plants 3 feet apart in the rows, and allowed to grow naturally. The green tomatoes that remain on the vines at the close of the season may often be gathered before they become frosted, and ripened in a room having considerable moisture in the air and a temperature of about 55° or 60° F. Some gardeners follow the practice of pulling the vines with the green tomatoes attached and hanging them in the cellar for the tomatoes to ripen. Bonny Best, Pritchard, Break O'Day, Marglobe, Stone, and Ponderosa are among the

varieties most commonly grown in home gardens. The little yellow, pear-shaped tomatoes are often grown for making tomato butter and tomato preserves.

#### DISEASES OF TOMATOES

Tomatoes are subject to attack by 3 or 4 rather serious diseases, including Septoria or leaf spot, wilt, and blossom-end rot.

**Leaf spot.**—Leaf spot is caused by a fungus that attacks the leaves and stems, causing small circular spots with light centers and dark margins. It starts on the lower leaves and progresses upward, causing them to curl, dry up, and fall off, leaving the stems bare except at the tips.

**Control.**—The remedy is to plant only healthy plants and to spray thoroughly with bordeaux mixture, beginning as soon as the plants are set and repeating the treatment every 10 days.

**Wilt.**—The widespread and serious tomato disease known as wilt is caused by a fungus that lives in the soil and is also carried in the seed. It enters the roots from infested soil, grows into the water vessels, and produces an upward curling of the leaves, followed by gradual yellowing, wilting, and death of the affected plants (fig. 13).

**Control.**—To prevent this disease use clean, new soil for growing the plants; and if the home garden has become infested with wilt, plant only wilt-resistant varieties such as Pritchard, Marvel, and Marglobe.

**Blossom-end rot.**—This rot, while not clearly understood, is known to cause large, dark, sunken spots on the blossom end of the green fruits.

**Control.**—The disease seems to be worse during dry weather, and watering and frequent cultivation seem to be the only remedies. Growing the crop on land containing plenty of organic matter to increase the water-holding capacity of the soil seems to help.



FIGURE 13.—Tomato wilt (late stage), showing dead leaves and stems and unfruitfulness.

#### INSECTS THAT ATTACK TOMATOES

Tomatoes are attacked by three insects—tomato hornworms, tomato fruit worms, and flea beetles.

**Tomato hornworms.**—Tomato hornworms are large green worms that feed on both tomato and tobacco plants (fig. 14). There are two kinds of hornworms, both very much alike, and in the moth or adult stage they are known as humming-bird moths. A large hornworm can strip a tomato plant of its foliage in 2 or 3 nights, leaving only the stems.

**Control.**—Hand picking is the best remedy in the home garden. The worms are about the color of the tomato vines and are very hard to see. Therefore, the vines should be examined carefully each day, after the work of the worms becomes noticeable.

**Tomato fruit worm.**—The tomato fruit worm, also called the corn ear worm, is the cause of much trouble to tomato growers, as it eats into the ripening fruit and destroys it.

**Control.**—This insect may be partially controlled by spraying with calcium arsenate or paris green, but it is not safe to spray the fruits after they become half grown. All tomatoes from sprayed vines should be washed or wiped thoroughly before being used.

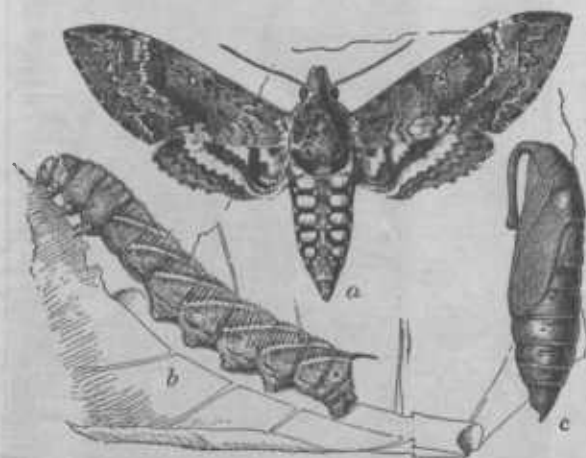


FIGURE 14.—Tomato hornworm: a, Moth; b, hornworm; c, chrysalis. About one-half natural size. (Howard.)

**Flea beetles.**—The potato flea beetle frequently attacks tomatoes and does much damage. It is especially troublesome on the young plants and is often carried to the garden with the plants.

**Control.**—Dipping the plants in a solution consisting of 3 ounces of calcium arsenate in 1 gallon of water before setting them out is effective. The thorough spraying of the plants with bordeaux mixture is also effective, as this will drive the beetles away.

#### PEPPERS

The sweet or bullnose pepper is very popular as a garden vegetable. The seeds should be sown indoors early in the spring, and the plants set in the garden after all danger of frost is past. Peppers require a very rich soil, and if kept well cultivated, watered, and free from weeds the plants will continue to produce until frost. Chinese Giant, Ruby King, World Beater, and California Wonder are among the leading varieties of large sweet pepper. The pimiento is a medium-sized, thick-walled, sweet pepper that is especially fine for preserving and is largely used for making the canned pimientos sold in the stores. There are also numerous varieties of Cayenne or hot peppers that are used for seasoning and for making chili and hot pepper sauces for use on meats and in stews.



## DISEASES AND INSECT PESTS

Peppers are subject to a number of diseases, but these are not as a rule serious in the home garden.

Peppers are practically free from insect injury in the home garden, so much so, in fact, that the subsistence gardener will seldom encounter any difficulty in this line.

## EGGPLANT

Eggplant is a warm-weather crop, and the plants must be started indoors and planted in the open after the weather has become warm. The plants must be kept growing vigorously from the very start; otherwise they will become tough and woody, and when once they reach that condition they are practically worthless. The plants should be set about 3 feet apart in each direction, and the soil should be very rich and well drained. Black Beauty, Early Long Purple, and New York Spineless are the leading varieties. Eight or ten plants will usually produce all of the large fruits that an average family will consume.

## DISEASES OF EGGPLANT

Certain leaf and fruit diseases attack eggplant, especially when the crop is grown on a large scale, but where only a few plants are grown in the home garden there is not likely to be any serious loss from diseases.

*Control.*—Spraying the plants with bordeaux mixture will very largely prevent the development of diseases.

## INSECT ENEMIES

The young plants of eggplant are frequently injured by flea beetles, and the presence of these insects is manifest by the appearance of small round holes in the leaves.

*Control.*—Spray or dust both sides of the leaves with calcium arsenate. As a spray the calcium arsenate may be used in combination with bordeaux mixture. Bordeaux mixture alone has the effect of driving the insects away. A dust of 1 part of calcium arsenate to 8 parts of hydrated lime may be effectively used. *Be careful about the use of arsenical poisons on the plants after the fruits begin to form.* The common Colorado potato beetle is also troublesome on eggplant, but it may be controlled in the same manner as flea beetles.

## SQUASHES AND PUMPKINS

Summer squashes, especially the Summer Crookneck type, should be included in practically every subsistence garden. Winter squashes, especially those of the Boston Marrow and Hubbard types, may often be grown to advantage and stored for winter use. These winter squashes are good for planting in the sections that are too far north for the growing of sweetpotatoes. All kinds of squashes require a rich, well-drained soil, and it is a good idea to work a shovelful of rotted manure and a small handful of commercial fertilizer into each and every hill. The early or summer squashes may be planted



in hills 4 to 5 feet apart in each direction, but the winter squashes should be spaced at least 10 feet apart in each direction. About 7 or 8 seeds should be planted in each hill, and after the plants are started they may be thinned to about 3 in a hill.

The early or summer squashes should be gathered and used while the skins are still tender so that they can be punctured with the thumb nail. In the case of the winter squashes they should be allowed to remain on the vines until fully ripened; however, they should be gathered and stored before there is any actual freezing.

The methods of storage are similar to those for sweetpotatoes; that is, they should be placed on shelves or in crates and cured at a temperature between 80° and 85° F. for several days, then be kept at a temperature around 55° or 60°. A shelf in the furnace room of the home is often a good place to store the winter supply of squashes. In handling them when they are to be stored it is important that they be handled carefully and that the skin does not become punctured. They should be gathered with a short piece of the stem attached to them.

Pumpkins may be planted in the corn patch or on ground where early crops have been removed. Their culture is the same as for squashes except that they make a rather long vine growth and need more room.

The Connecticut cheese or pie pumpkin is one of the best varieties for growing in the home garden.

Pumpkins should be stored in exactly the same manner as winter squashes.

#### DISEASES OF SQUASHES AND PUMPKINS

Squashes and pumpkins are subject to a mildewing of the leaves and certain leaf spot diseases, but none of these prove very serious in the home garden, and for that reason the subsistence gardener need not consider them unless more serious outbreaks than normal should occur.

*Control.*—Spraying the foliage and stems with bordeaux mixture will often largely prevent the occurrence of any of these diseases.

#### INSECTS AFFECTING SQUASHES AND PUMPKINS

The striped cucumber beetle very frequently attacks the young seedling squashes and pumpkins just as they emerge from the ground. Dusting the plants with a mixture of 1 part calcium arsenate and 5 or 6 parts hydrated lime is usually effective in controlling these insects. When only a few hills are being grown in the home garden it is often possible to cover the hills with small pieces of cheesecloth until the plants are well established and less liable to attack by the striped cucumber beetle. The cheesecloth should be supported on arches made of wires or barrel hoops set over the plants, the edges of the cheesecloth being weighted down with soil.

Another method is to start the hills of early squashes in quart berry boxes of soil in the hotbed or coldframe. By the time the plants can be set in the open they will be past the stage of most serious attack by the striped cucumber beetle.

Squashes and pumpkins are also attacked by aphids which work on the underside of the leaves. Spraying or dusting the plants with nicotine will control these insects.

Squashes are frequently killed by the squash vine borer which enters the stem at or near the surface of the ground and bores tunnels in the squash vines as shown in figure 15. When the borers attack the squash vines it is almost impossible to kill them without killing the plants. The borers may sometimes be cut out of squash vines by slitting the stems of the vines lengthwise. Afterwards, these portions of the vines should be covered with soil to help the plant grow extra roots.

#### MELONS

Muskmelons and watermelons are not recommended for growing in subsistence gardens except under the most favorable conditions and where there is plenty of land available without restricting the planting of more important food crops. The culture of muskmelons is practically the same as that for squashes and pumpkins. Muskmelons may be grown on any good garden soil, but watermelons are at their best when grown on a warm, sandy loam. There are a great many varieties of muskmelons, but those of the Netted Gem type are considered best in most localities. Throughout Ohio and Indiana, the variety known as Tip Top is largely grown. In Michigan Hearts of Gold is ordinarily grown. Owing to the uncertainty of producing a good quality of muskmelon in the home garden, subsistence gardeners should go rather slowly in the planting of this crop at least until they determine how the crop should be grown. Watermelons are even less desirable for planting in the subsistence garden because they require a large amount of space and a particular type of soil.

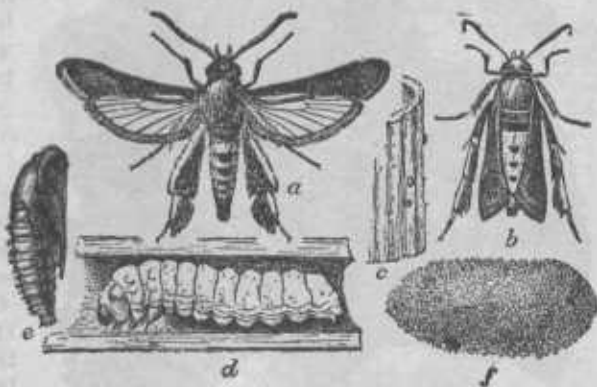


FIGURE 15.—Squash borer: *a*, Moth with wings spread; *b*, moth at rest; *c*, egg on section of vine; *d*, caterpillar or grub in squash vine; *e*, chrysalis; *f*, chrysalis cell from ground. Enlarged one-third. (Chittenden.)

#### DISEASES OF MELONS

Three important diseases—anthracnose, downy mildew, and blight—all ordinarily called "blight" or "leaf spot", may attack the muskmelon when weather conditions are favorable, frequently resulting in heavy losses. All three diseases are caused by fungi. They often develop and spread rapidly in moist, warm weather and are characterized by brownish, more or less rounded or angular spots (fig. 16), which enlarge and soon cause the leaves to turn yellow, curl, dry up, and die. Watermelons are also subject to leaf diseases but not to the same extent as muskmelons.

*Control.*—Spraying the foliage thoroughly with bordeaux mixture is fairly effective in preventing the development of these leaf diseases.

The spraying should begin early or just as soon as the first leaves are formed and be repeated at intervals of every week or 10 days until the crop is all gathered.

#### INSECTS AFFECTING MELONS

The young seedling melon plants are subject to attack by the striped cucumber beetle the same as squashes, and the control measures are also the same.

Aphids or plant lice are especially troublesome on muskmelons (fig. 17) and to a considerable degree on watermelons. The control is the same as for squashes.

The squash vine borer will occasionally attack muskmelons, but the danger of loss is not as great as with squashes and pumpkins.

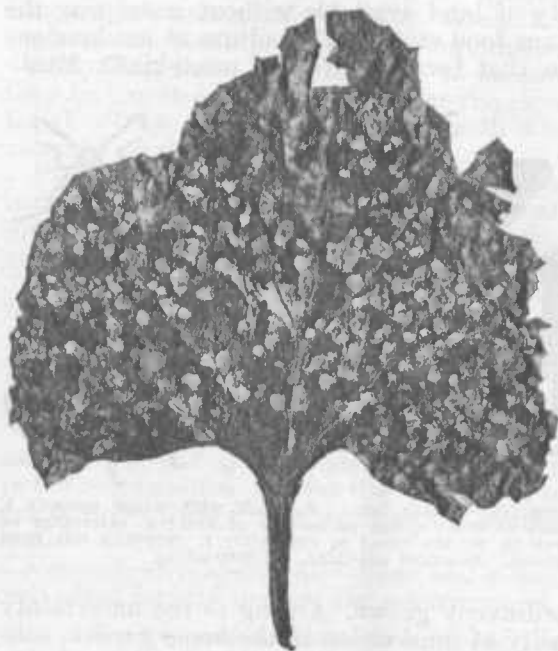


FIGURE 16.—Muskmelon leaf spot.

#### CUCUMBERS

Cucumbers, while not of great actual food value, should find a place in most subsistence gardens. They add variety and freshness to salads although there are certain people who cannot safely eat them. Cucumbers are also highly desirable for the making of pickles and relishes. The culture of cucumbers is the same as that for squashes and melons.

White Spine is one of the leading varieties. Where cucumbers are grown mainly for pickles the Boston Pickling variety should be planted.

#### DISEASES OF CUCUMBERS

The diseases of cucumbers are practically the same as those of muskmelons (see p. 39).

#### INSECTS ATTACKING CUCUMBERS

The striped cucumber beetle and the aphids or plant lice are the most troublesome insects on cucumbers. Cucumbers are sometimes killed by the squash vine borer. Splitting the stems and removing the grubs is the best known remedy.

## SWEETPOTATOES

In the warmer sections of the territory to which this bulletin applies, especially along the Atlantic coast, and in Indiana, Illinois, Iowa, and Missouri, the sweetpotato is an important home-garden crop. While sweetpotatoes do not entirely take the place of potatoes they should be included in the garden plan wherever soil and climatic conditions are suitable for growing them. They require a rather light, warm, sandy soil, and while it is desirable to have plenty of decayed manure or organic matter in the soil the sweetpotato will respond very readily to the application of commercial fertilizers.

The plants with which to start the crop must either be grown from seed potatoes in a hotbed or they may be purchased from southern plant growers. The plants are usually set on ridges, the ridges being made 34 to 40 inches apart and about 8 inches in height but rather broad at the base.

About an 8-quart pailful of fertilizer that is rather high in potash content may be sown to each 100 feet of row, being applied before the ridges are made up.

The ridges should be made at least 3 or 4 days before the plants are set, but in case the ridges are not made until the time of setting the plants the fertilizer should be most thoroughly mixed with the soil before making the ridges. The plants should be set about 14 inches apart on the ridges and about a pint of water should be used around the roots of each plant as it is being set.

Sweetpotato plants should not be set in the open until all danger of frost is past and the ground is fairly warm. Yellow Jersey and



FIGURE 17.—Melon leaves curled by the melon aphid.  
(Chittenden.)

Bigstem Jersey are two of the leading varieties of the dry-fleshed type. Nancy Hall and Porto Rico are most frequently planted of the moist types of sweetpotatoes.

In the fall when frost kills the sweetpotato vines the potatoes should be carefully lifted from the soil with a spading fork or with some tool that will not bruise or damage them, and they should then be stored in a warm, well-ventilated place, preferably in crates or open slat baskets and given a curing period of about 10 days or 2 weeks at a temperature somewhere in the neighborhood of 85° F. This curing process dries out the potatoes and largely prevents the development of rots and other diseases. After the curing period the potatoes should be kept at a temperature of about 55°, but always dry and with plenty of ventilation.

Where only a few crates of sweetpotatoes are to be stored they can often be kept to advantage on a shelf or a table near the furnace in a dry basement, or near a heater stove in which a slow fire is kept during cold weather.

#### DISEASES OF SWEETPOTATOES.

Sweetpotatoes are subject to a number of diseases, but only 2 or 3 are troublesome in the home garden. Black rot and scurf are common on all varieties and stem rot may be prevalent on the Jersey types, and on the Porto Rico and Nancy Hall. When the plants become diseased in the field, very little can be done to save them. Scurf, sometimes called soil stain, discolors the skin of the potato, but it does not affect the eating qualities. There are also a number of serious disease troubles in storage.

Most of the diseases of sweetpotatoes in the garden and in storage can be controlled if care is taken to set only clean plants. If the potatoes are to be stored they should be carefully handled during the operation of digging and storing in order not to bruise and injure the skin. Proper curing after the potatoes are placed in storage will greatly reduce the chances of loss from storage diseases.

#### INSECTS ATTACKING SWEETPOTATOES

In the more northern sections where sweetpotatoes may be grown in subsistence gardens there are no very serious insect pests to be reckoned with. In the South the sweetpotato weevil is a troublesome pest. Grasshoppers frequently damage the sweetpotato vines, but these can be controlled by the distribution of poisoned bran mash as described on page 10.

#### FRUITS FOR THE SUBSISTENCE GARDENS

Planting fruit of any kind on the subsistence homestead should be secondary to the establishment of the vegetable garden, but certain of the small fruits like strawberries, raspberries, blackberries, and grapes come into bearing comparatively quickly, and whenever the conditions are favorable these fruits should be planted as early in the program as possible. It is doubtful, however, if those who are undertaking subsistence farming should rush into the planting of tree fruits, and perhaps in the long run better results will be obtained by delaying the planting of fruit trees until time has been given to study the situation, to carefully select the location for the various trees, and to determine the best varieties to plant.

Another angle to the growing of fruit for home use is the problem of its protection from diseases and insects. There was a time when a fair grade of fruit could be grown without spraying or dusting, but that time has long since passed, and to be successful in the production of good fruit the grower must now follow a definite schedule of spraying or dusting in order to keep his trees free from insects and diseases.

It has been suggested that certain fruit trees might very properly be planted around the home, where they will serve both for shade and for the production of fruit to be used in the home. This use of fruit trees should, however, be very carefully studied before any planting is done, as overripe or decaying fruit has a tendency to attract flies and bees. Decaying fruit is also objectionable from a sanitary standpoint. As a general rule, tree fruits should be planted by themselves and where it will be most economical to give them the proper care, especially as regards spraying or dusting. The following pages contain brief instructions for the benefit of those who may desire to make an early start in the growing of fruits for home use.

#### STRAWBERRIES

Strawberries are adapted for growing in practically every part of the country, and come into bearing within a comparatively short time after they are planted. Plants that are set in the spring or early summer will give an abundant crop the following year. For the average family 100 to 150 plants will be sufficient at the beginning. These should be set in rows 3 or  $3\frac{1}{2}$  feet apart and 18 to 24 inches apart in the rows.

There are two systems of growing strawberries for home use—the hill system and the matted-row system. According to the hill system the original plants are set somewhat closer, and very few new plants are allowed to form, the plants being kept in distinct hills; according to the matted-row system, a large number of plants are allowed to form, and these are kept trained in the form of a matted row 12 to 18 inches in width, the plants being thinned or spaced so as to stand from 6 to 8 inches apart in the row.

In setting strawberry plants extreme care must be taken that they are not placed so deep that the hearts or crowns will be filled with soil during rains; on the other hand they should not be set so shallow that any part of the roots will be exposed above ground. In other words, they should be set at the same level that they grew in the original bed.

Strawberries require a moderately rich soil, especially one that is reasonably free from grass and weeds. They can be grown on all types of soils except those that are wet or extremely sour. Where there is any question about drainage the plants should be set on a slight ridge or bed. Where the plants are set during the early spring, the blossom stems should all be clipped off and no fruit allowed to set the first season.

There are many good varieties of strawberries, but certain of them are better adapted than others for the different sections of the country. The Premier, or Howard 17 as it is properly called, is perhaps the most universally grown throughout the northeastern United States. Recently a number of new varieties have been introduced, prominent among these being the Dorsett and Fairfax, especially for

the northeastern section, and the Blakemore for the southern sections north of Florida. The season for ripe strawberries can be very materially extended by planting early, medium, and late varieties. Gardeners are advised to consult their local county agricultural agents as to the best varieties to plant in their respective sections.

While strawberry plants will produce their best crop the season following the setting of the plants, the bed may be cleaned out after the first fruiting season and carried over for another year. After the second year, however, it usually pays to start a new bed and plow under the old one. Where the bed becomes grassy or extremely weedy, it is difficult to renovate and carry it over. Many growers follow the practice of setting a small bed each year and destroying the old bed after it produces its second year's crop.

#### DISEASES AND INSECT ENEMIES

The diseases and insects of strawberries as encountered in the home garden are not especially important; the main point is to select good vigorous varieties that are adapted to each particular region. Strawberries are sometimes affected by certain leaf-spot diseases, but, as a rule, these troubles can be sufficiently overcome by good cultivation. The large white grub of the May beetle often does considerable harm; for that reason strawberries should not be planted on land where a heavy sod has been turned under, nor should fresh cow manure be used as a fertilizer.

#### RASPBERRIES

Raspberries are not recommended for extensive planting in the Southern States, and only the most hardy varieties are adapted for growing in the colder parts of the Northeastern and North Central States. This practically limits the growing of raspberries in home gardens to the North Central States and the parts of the Northeastern States where the temperature does not ordinarily go lower than 15° below zero. In northern Minnesota and the Dakotas, raspberries are frequently grown by laying down the canes in the fall and covering them with earth, and then uncovering them in the spring, but the winters are too severe in that section for growing raspberries by the ordinary methods.

One hundred hills or plants of raspberries will be an abundance for growing in the average home garden, and the grower has a choice among the black, purple, and red varieties. Among the black varieties most commonly grown in home gardens are the Cumberland, Plum Farmer, and Gregg; Cardinal, Columbian, and Royal Purple are leading purple varieties; and Cuthbert, Latham, Van Fleet, and Ranere (St. Regis) are among the best red varieties. The Van Fleet will grow well to the southward, while the Ranere is somewhat of an everbearer, producing an early summer crop which is sometimes followed by a fair crop in the late summer and fall. The Latham is a late berry of Minnesota origin and one of the most hardy of all the raspberry varieties.

Raspberries require a well-drained, rich soil with plenty of humus to prevent drying-out. In preparing the soil for planting it is a good plan to open a trench and work manure and a little bone meal or mixed fertilizer into the soil. The red varieties of raspberries are propagated by shoots that come up from underground roots. These



are lifted and reset either in the fall or early in the spring before the buds start. The black varieties are started from tip layers where the tips of the canes bend over and touch the ground, take root, and start new plants. These new plants are lifted with a little soil around their roots and planted in a new location. New canes are formed each season and bear the crop of the following season, after which the old canes die and should be removed. The fall crop of the Ranere variety is borne on the tips of the new canes; then these same canes throw out branches and bear the crop the following season.

Raspberries should be given plenty of space; the rows should be 4 to 5 feet apart and the plants 3 feet apart in the rows. Two years are required after planting before any considerable crop will be borne; if the bed is kept clean and the plants well worked and fertilized, the plants should last for years. One of the real problems is to get plants that are free from crown gall and other root diseases. If the plants are purchased from a nursery the gardener should insist that they be guaranteed to be free from these diseases. Spraying the plants each winter with lime-sulphur solution will very largely control scale insects and bark diseases, but it is very essential that good plants be secured to start with. After a start is once made it is easy to produce all the plants required for replacements and new plantings.

Raspberry canes should be tied to stakes or wires so as to be held off the ground, especially during the fruiting period. The usual method of supporting the canes is to stretch wires on light posts about 30 inches aboveground and tie the canes to them.

Mulching the raspberry plants with coarse manure will aid greatly in holding soil moisture and at the same time help to keep down weeds.

#### BLACKBERRIES

Blackberries grow naturally throughout the greater part of the Northeastern States, and in many sections the wild varieties give fair results. However, it is better to plant 40 or 50 hills of one or more of the cultivated varieties. Blackberries require a deep, rich soil containing plenty of organic matter to hold moisture. In case the soil is poor and thin, some form of organic matter such as manure or decaying vegetable matter should be worked into it before the berries are planted. Blackberry plants should be set as early in the spring as the land can be worked, the plants used consisting of rooted shoots of the previous year's growth. They should be set as deep as, or perhaps just a little deeper than, they stood in the original patch or nursery. Plants set during the spring will produce a moderate crop the following spring and a good crop the second or third spring after setting.

Blackberry plants should be given 6 to 8 feet between rows with the hills  $3\frac{1}{2}$  or 4 feet apart in the rows. One method of planting blackberries is to place the rows about 8 feet apart; then grow vegetables such as cabbage or potatoes in the spaces between the blackberry rows. After 2 or 3 years, if the plants make a good growth, they will require practically all of the space. Blackberries require thinning because if all of the suckers are allowed to grow by the end of the second or third year the patch would be a dense thicket of blackberry canes just as they grow in the wild.

Some form of support is desirable; in fact, the plants should be either staked and tied, or wires should be stretched on posts and the canes tied to them.

Like raspberries, blackberries are greatly improved by mulching with straw or some coarse material that will help to conserve the moisture.

Blowers, Brainerd, Early Harvest, Eldorado, Lawton, and Snyder are among the leading varieties; however, because of the different behavior of the several varieties in various sections of the country it is always well to consult a local grower regarding the selection of varieties for any particular locality.

The cultivation of blackberries is not difficult and consists mainly of keeping the patch free from weeds and grass and heading back the new canes when they reach a height of 3 or 3½ feet in order to make them branch. The old canes should also be removed after they have produced their crop of fruit.

#### DEWBERRIES

Dewberries are grown practically the same as blackberries; however, they are not as hardy as blackberries, and only the most rugged varieties will stand the northern winters. Where blackberries are grown for home use it is scarcely worth while to grow dewberries in addition.

The Lucretia and Young dewberries are the main varieties for the South, but the former can be grown well to the northward if the canes are protected by covering during the winter. Unlike the canes of the blackberry, those of the dewberry are trailing, and it is necessary to tie them to stakes or to horizontal wires.

#### DISEASES AND INSECT PESTS OF RASPBERRIES, BLACKBERRIES, AND DEWBERRIES

Raspberries, blackberries, and dewberries frequently do very well without treatment for the control of diseases and insect pests.

**Anthracnose.**—If the disease known as anthracnose is serious, blackberries and dewberries may be sprayed with bordeaux mixture just as the buds are breaking, followed by two more applications at intervals of 2 weeks. For the control of anthracnose raspberries may be sprayed with bordeaux mixture once only, just as the leaves begin to show green. Additional applications are apt to cause serious injury.

**Raspberry mosaic.**—Raspberry mosaic makes the leaves crinkly and off color. Affected plants become nonproductive and should be promptly removed to save the others, as the disease is infectious. Plant only disease-free stock.

**Rust.**—An orange-colored rust attacks and destroys raspberry, blackberry, and dewberry bushes. Infected bushes should be removed at once. Insist upon getting disease-free nursery stock.

As a rule insects do not trouble raspberries, blackberries, and dewberries.

#### GRAPES

Grapes of one type or another can be grown in practically every section of the country. For planting in the South the Thomas and Scuppernong varieties are recommended, whereas in the northeastern section the American bunch grapes such as Concord, Niagara, Moore Early, and 1 or 2 others are recommended. The usual method of propagating grapes is by means of cuttings, and 1-year plants are as a rule used for planting. There are several methods of training

grapes—on trellises, on arbors, and on posts. The two-wire trellis with the wires stapled to posts is undoubtedly best where fruit production is the primary object. Grape arbors serve a dual purpose of furnishing shade, and, under favorable conditions, growing large quantities of grapes. The danger of loss from diseases, however, is somewhat greater when the vines are trained on arbors than when they are on trellises.

One row of grapevines across the back of the lot or along one side of the garden is generally sufficient to supply all the grapes needed by the average family. This will require 8 or 10 vines, which should be planted fully 12 feet apart.

Grapes require a reasonably rich, well-drained soil, and they grow well when conditions are right for them. Manure and fertilizer may be used to enrich the soil in the beginning; then top-dressings of fertilizers and mulches of straw or some other material will aid in keeping the vines in a vigorous growing condition. Grapevines send their roots to considerable distances. They draw

rather heavily upon the soil moisture and plant food and, if planted along one side of the garden, are likely to seriously affect the crops of garden vegetables.

Grapevines grown on good land may produce a few bunches of grapes the second year after planting, but as a rule no considerable crop is obtained until the third or fourth year. Careful and systematic pruning of the vines is the secret of success in grape culture. Pruning should be done during the early winter and in case of the

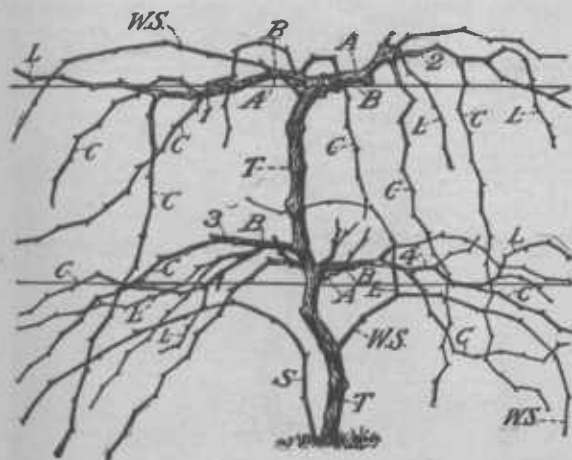


FIGURE 18.—Diagram of a grapevine before pruning, showing the different parts and illustrating the 4-arm system of training: A, Arms or ramifications of the branches, usually of wood 2 or more years old; B, branches which are of mature wood, being several years old; C, canes, called shoots when green and canes when mature; L, laterals, the secondary shoots of a cane; S, suckers, the shoots starting below the ground from the main body; T, trunk, the stem or main body of the vine; W.S., water sprouts, the shoots which start above the ground from wood older than 1 year; 1, 2, 3, 4, 2-year-old arms

American or bunch grapes, such as Concord, Niagara, Moore Early, and Delaware, the shoots that grew the previous year should be cut back so as to leave about three good buds on each. These buds in turn will produce new shoots on which three or four bunches of grapes will be borne the following season. If too many buds are left on the vines the new growth will be weak and the bunches small. On a 3-year-old vine not more than 20 buds of last year's growth should be allowed to remain; on older vines 20 to 40 buds may be left, the number depending upon the vigor and strength of the vine. One principle that should be observed in the pruning of bunch

grapes is to keep the bearing wood as near to the main stem of the vine as possible. By the usual method of training on wire trellises about 4 side branches, 2 in each direction, are allowed to remain. These in turn may form three or four lateral branches on which the crop is borne. The proper method of pruning a grapevine by the 4-arm system is shown in figures 18 and 19.

Where the 2-wire-trellis method of training is used the wires are stretched on posts, the first wire about 28 inches from the ground and the second wire at a height of about 4 feet. The vines are trained so that there will be side branches at the proper height to tie to these wires. This gives an ideal arrangement from the standpoint of spraying and picking the fruit. If these lateral branches eventually become too long and too old to produce good crops, new lateral branches may often be started from the main trunk of the vine and the old branches removed. This provides for a renewal of the bearing portions of the vines. In all cases the vines should be securely tied to the wires. A certain amount of pinching back and thinning out of the weak shoots is permissible during the growing season.

#### DISEASES AND INSECT PESTS

The principal diseases and insect pests of the grape, such as black rot, flea beetle, berry moth, etc., can be controlled by spraying with bordeaux mixture to each 5 gallons of which 3 level tablespoonfuls of powdered arsenate of lead is added. The first spraying should be applied when the young shoots have just started in the spring and are about 4 inches long, the second just before the blossoms open, the third just after the blossoms have fallen, and the fourth about a week later; for this application a tablespoonful of nicotine sulphate should be added to each 5 gallons of the spray to control plant lice.

Since these sprays are poisonous, the arsenate of lead and the nicotine should be omitted from applications made after the grapes become as large as garden peas, and all sprayed fruit should be thoroughly washed before it is eaten or offered for sale.

Covering the bunches of grapes with paper bags soon after the blooming period is an effective means of protecting them from most diseases and insect pests without the subsequent use of sprays.

Small flying insects known as leaf hoppers frequently do great damage to grapevines. Spraying with bordeaux mixture is usually quite effective in controlling them.

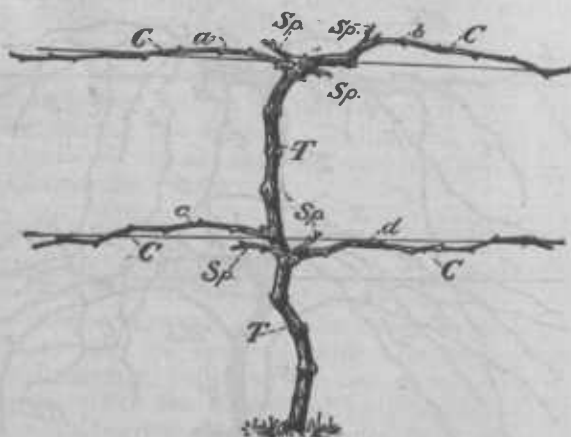


FIGURE 19.—A vine pruned according to the 4-arm system: *C*, Canes, called shoots when green and canes when mature; *Sp.*, spurs, canes cut back to 1 to 4 eyes; *T*, trunk, the stem or main body of the vine; *a*, *b*, *c*, *d*, arms succeeding those shown at their 2-year-old stage in figure 20 at 1, 2, 3, 4.

## APPLES

Apples should not be planted on the subsistence farm unless conditions for their growth are reasonably good. Apples require a rather deep and fairly rich, well-drained soil, and they should be planted only on high ground where the air drainage is such that the blossoms will not be killed by late spring frosts. Apples require special spraying or dusting in order to protect the fruit and foliage from insects and diseases. Considering all these points, it is doubtful if a very large percentage of those engaging in subsistence farming will be justified in planting apple trees. Under reasonably favorable conditions, however, it may be desirable to plant a few trees,

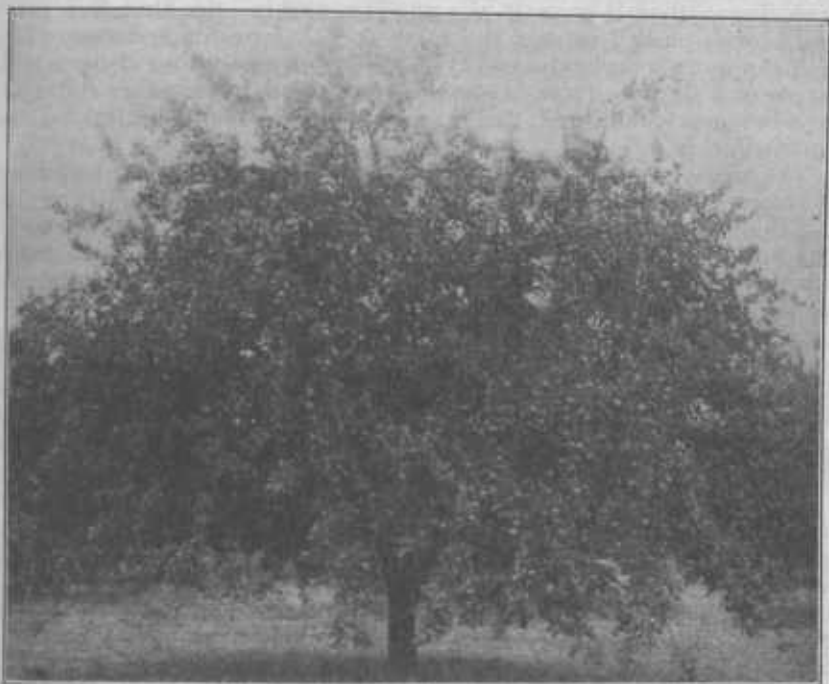


FIGURE 20.—A desirable form for a mature apple tree, such as may be developed by judicious pruning. This tree is about 30 years old.

including 1 or 2 early varieties or 1 or 2 late summer and fall varieties, and about 2 or 3 late or winter varieties. It should be borne in mind that varieties differ with location, and in planting apples for home use the local growers who have had experience should always be consulted as to the best varieties. The county agent can usually give advice as to the best varieties to plant in a given locality.

It is seldom satisfactory to plant one apple tree with the idea of getting any considerable amount of fruit, unless nearby neighbors have apples on their places from which the bees may carry pollen to fertilize the apple blossoms. Very few varieties set fruit in abundance from their own pollen. Grimes Golden is self-fertile to a high degree, and in addition, this variety is extensively used as a pollinizer

for other varieties. Where a single apple tree is grown, a crop of fruit may often be procured by cutting a few branches bearing the blossoms from some other apple tree known to be a good pollinizer, such as Grimes Golden, placing them in a pail or jar of water, and hanging them in the isolated tree where the bees may visit the blossoms and carry the pollen to the blossoms on the tree.

Apple trees eventually grow to considerable size and should be spaced at least 30 and preferably 35 to 40 feet apart. Well-grown, 2-year-old nursery trees are to be preferred for planting on subsistence farms. In planting apple trees, or any kind of a tree for that matter, it is important that the roots be protected from drying out during handling. Set the tree at the same depth or perhaps an inch deeper than it grew in the nursery, and be sure that fine, moist soil is well packed around the roots and that no air spaces are left. Fill the holes completely and tramp the soil, mounding it up a trifle to prevent the tree from being whipped about by winds. After the tree becomes established, the ground about it should be leveled and cultivation practiced.

The shape of an apple tree depends to some extent on the pruning it receives during the first 3 or 4 years after it is set out. It is during this period that the main or scaffold branches are established and the entire crown of the tree formed. In general, an apple tree should be pruned with more or less of an open head so that the sunshine may reach the inside of the branches.

For home fruit production, especially where the trees are to be used for shade, or where crops are to be grown in the spaces between the trees during the first 3 or 4 years, it is best to train the trees fairly high above the ground but not so high as to make spraying and picking the fruit difficult. Figure 20 shows a desirable form for a mature apple tree.

#### PEARS

Pears are somewhat better adapted for growing in the subsistence garden than are apples, because they require less space and come into bearing at an earlier age. Pears do not require as rich a soil as apples or peaches, in fact, if they are planted on rich soil or given applications of fertilizers and clean culture they are very likely to be attacked by blight. The varieties of pears to be planted in the subsistence garden will depend upon locality, but the Bartlett, Seekel, and Angouleme are among those most commonly planted in northern sections. The Bartlett is undoubtedly the choicest market and home variety, but it is extremely susceptible to blight. The Kieffer variety is less susceptible to blight, and while the fruit is of inferior eating quality to that of the Bartlett it is a heavy bearer and the fruit is of fair quality for canning and preserving. One or two trees of the Kieffer variety will generally be sufficient to furnish all of this class of fruit required by the average family. The quality of Kieffer pears is greatly improved by picking them carefully to avoid bruising and then storing at a temperature of 60° F. until they soften slightly.

Pear trees may be spaced 20 to 25 feet apart and should be located on ground that is not used for the growing of any cultivated crop.

## DISEASES AND INSECT PESTS OF APPLES AND PEARS

Most diseases and insect pests of the apple and pear, such as scab, rot, the various leaf spots, San Jose scale, codling moth or apple worm, and caterpillars, can be largely controlled by spraying. Dusts may be used instead of sprays in all applications except for the dormant or winter sprays, and while not generally so effective during the growing season as the sprays, they are more easily and rapidly applied. The following schedule will give control of the more important diseases and insect pests:

(1) Lime-sulphur, 1 pint to 1 gallon of water or 3-percent oil emulsion, to be applied before growth begins in the spring.

(2) Lime-sulphur, 1 pint, and arsenate of lead, 3 level teaspoonfuls in 5 gallons of water, or a dust composed of dusting sulphur 9 parts and arsenate of lead 1 part by weight, to be applied, (a) just before the blossoms open, (b) just after the petals have fallen, (c) 3 to 4 weeks later, and (d) 3 weeks later.

It must be remembered that, since these sprays and dusts are poisonous, all fruits treated with them should be thoroughly washed before being eaten or offered for sale. The same sprays may be used on sour cherries at the same time, but not on peaches, plums, and sweet cherries. The sprays recommended on page 53 for peaches and plums may also be used safely on apples, pears, cherries, and apricots; they will not control apple and pear pests as well as the lime-sulphur and oil sprays, but if one set of sprays is desired for all these fruits, the set recommended for peaches and plums should be used. All rotten, wormy, and scabby fruit should be removed from the tree or from the ground and destroyed.

**Cankers.**—Cankers or dead areas in the bark should be carefully removed with a knife or carpenter's gouge, in the same way that the cankers caused by pear blight are removed.

**Blight of apples and pears.**—Apples and pears are subject to an infectious disease which causes blossoms and twigs to turn black and die in the spring, and makes dead areas in the bark of large limbs and trunks. Infected twigs should be removed as soon as they show any infection; they should be cut about 6 inches below the infected areas. The dead areas of bark should be removed with a knife or carpenter's gouge, the cut extending well back into living bark. The tools should be sterilized after each cut by being swabbed with a 1 to 1,000 solution of corrosive sublimate obtainable at any drug store. Large wounds should be painted over with ordinary house paint or with coal tar thinned with creosote.

**Cedar rust of apple.**—Orange-colored spots on the leaves and fruits of the apple are produced by a fungus that must live during part of its life on the red cedar. Removing the cedar trees in the vicinity of the orchard is the only practical remedy, but this is frequently not practical for small plantings.

## PEACHES

Peaches are among the most uncertain of the tree fruits that may be planted in the subsistence garden. The trees come into bearing the third or fourth year after planting. They seldom live more than 20 years, and crop failures due to the killing of the blossoms



by frost are of very common occurrence. Commercial peach growers consider that if they can secure a crop 3 years out of 5 they are doing very very well.

Among the varieties of peaches that may be planted in many sections in the subsistence garden are Belle and Elberta, although numerous other varieties are grown in special localities. The grower is advised to seek the advice of some experienced fruit grower before making up his list of varieties.

Peach trees should be planted 16 to 20 feet apart and given clean, careful cultivation throughout their life period. The trees require



FIGURE 21.—A well-formed 6-year-old peach tree which has had systematic pruning.

pruning (fig. 21) every season in order to prevent the formation of too many buds, which result in a thick growth and the production of small fruit. This pruning usually takes the form of thinning out the branches and opening up the head of the tree so as to admit plenty of sunlight and at the same time prevent the tree from becoming too tall for convenience in thinning and picking the fruit. Whenever there is a heavy set of fruit, the fruit should be thinned so that the individual fruits will be 4 to 6 inches apart on the branches. A good type of peach tree is shown in figure 21.

#### PLUMS

Plums are well adapted for growing on the subsistence farm, especially in the poultry yard and in out-of-the-way places where they will not seriously interfere with other crops.

Lombard, Reine Claude (Green Gage), German Prune Shropshire (Damson), Abundance, and Burbank are among the varieties commonly grown in the North and the northeastern sections of the country. Certain varieties of plums, like Burbank, have a spreading habit of growth and should be planted about 15 feet apart; others, like Shropshire, are more upright in their habit of growth and may be planted as close as 12 feet apart.

Plums require a fairly rich soil and do best when they are given good clean cultivation.

#### CHERRIES

Wherever climatic conditions are suitable, cherries are probably the most desirable of all tree fruits for growing in the subsistence garden. They require the same soil and cultural conditions as apples. The trees may be planted as closely as 20 or 25 feet without serious crowding; however, cherry trees sometimes live to a great age and become quite large; in that case every second tree can be removed. From the standpoint of pollination, cherries, especially sweet cherries, are like apples, and it is necessary to have trees of more than one variety growing near each other in order to secure satisfactory crops of fruit. Cherries are not adapted for growing in the southern districts.

Among the sour cherries Early Richmond and Montmorency are the leaders, although English Morello is still planted as a late variety. Among the sweet varieties Black Tartarian, Yellow Spanish, and Windsor are popular in the sections to which this bulletin applies.

#### DISEASES AND INSECT PESTS OF THE PEACH, PLUM, AND CHERRY

Certain diseases and insect pests of the peach, plum, and cherry, such as scab, rot, San Jose scale, leaf curl, and curculio or worm, can be controlled by spraying or dusting as follows:

(1) Spray with lime-sulphur, 1 pint to 1 gallon of water, before the buds begin to swell in late winter, or in the fall after all leaves are gone. Dusts used at this time are not effective.

(2) Spray with wettable sulphur one-half pound and arsenate of lead (3 level teaspoonfuls) in 5 gallons of water, or dust with dusting sulphur 9 parts and arsenate of lead 1 part (*a*) about 10 days after the blossom petals have fallen or (*b*) when the shucks have been shed by the young fruits about 2 weeks later.

(3) Spray with one-half pound of wettable sulphur in 5 gallons of water, or dust with dusting sulphur about 2 to 4 weeks before the fruit is expected to ripen. No arsenate of lead should be used in this application.

Since these sprays and dusts contain poison, all sprayed fruit should be washed thoroughly before it is eaten or offered for sale.

These sprays may also be applied to other fruit trees with safety. As a clean-up measure, all diseased or wormy fruit should be picked from the trees and from the ground and destroyed.

**Plum and cherry black knot.**—The large black warty growths on limbs of plum and cherry trees should be removed and destroyed as soon as recognized by cutting off the affected limb at least 6 inches below the knot. Winter spraying with bordeaux mixture prevents infection.

**Insects.**—There is another very important group of insects that attack peach, plum, and cherry trees. These insects damage the bark or sapwood of the trunk and branches of the trees, and their presence is usually indicated by the formation of gum, commonly known as "gummosis."

The peach tree borer is considered the most devastating of these insects. It works mainly at the base of the tree. The presence of these borers can be detected by the presence of the gummy formation, and if a careful examination is made the worms will be found cutting tunnels in the bark of the tree trunk at the ground level. The trees should be examined during the early spring and again late in the summer and the worms removed by means of a sharp-pointed knife or a wire. There is a chemical known as paradichlorobenzene, about 1 ounce of which may be spread in a ring around the base of the tree during August and then mounded over with earth. The gas formed by this chemical, which is similar in appearance to naphthalene flakes, will smother the worms in their tunnels. It should not be used around trees that are less than 4 years old.

Other bark-eating insects of the peach in particular are bark beetles and shothole borers. The presence of these insects is also indicated by the exudation of the gum from the trunk and branches of the trees. In cases of severe infestation the trees are reasonably sure to be killed and should be removed and burned.

#### REFERENCE PUBLICATIONS

Farmers' Bulletin No. 879, Home Storage of Vegetables.

Farmers' Bulletin No. 1001, Growing Fruit for Home Use.

Farmers' Bulletin No. 1044, The City Home Garden.

Farmers' Bulletin No. 1242, Permanent Fruit and Vegetable Gardens.

Farmers' Bulletin No. 1371, Diseases and Insects of Garden Vegetables.

Farmers' Bulletin No. 1471, Canning Fruits and Vegetables at Home.

Farmers' Bulletin No. 1673, The Farm Garden.

Miscellaneous Publication No. 136, Conservation of Fertilizer Materials from Minor Sources.

Leaflet No. 70, Home Mixing of Fertilizers.

Any of the above bulletins may be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., by sending 5 cents in coin for each copy.